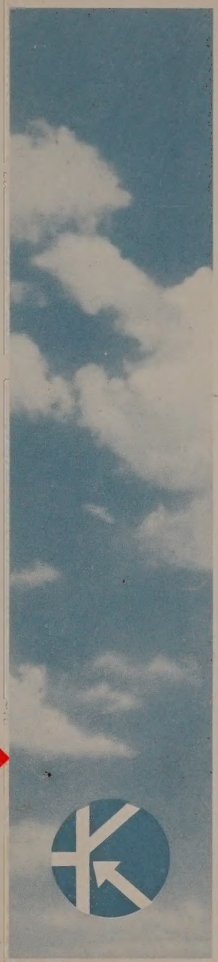


132-174 MC
2 W RF POWER

MOTOROLA

HT Series

"handie-talkie"®

fm radio

68P81032A30-B

Press the push-to-talk button in firmly and hold it. Speak slowly and clearly into the speaker grill in a normal-to-loud voice. Release the button to listen. The receiver is inoperative when the push-to-talk button is pressed.

g. Frequency Selection (Two-Frequency Models Only)

The switch on the top of the unit may be placed to position F1 or F2 to select either of the two operating frequencies.

h. Antenna Jack

The antenna jack (ANT is used for test purposes and for plugging in an external antenna. When this jack is used, the antenna which is part of the radio is automatically disconnected.

i. Speaker Jack

The speaker jack (SPKR) is used for test purposes and for plug-in accessories such as the lapel speaker and earpiece. The built-in speaker is inoperative when this jack is used.

j. External Microphone ("Universal" Models Only)

To attach the external microphone remove the protective cap from the microphone connector, plug in the microphone plug (check keyway alignment), and tighten the knurled ring nut. The radio may now be keyed with the microphone push-to-talk switch, which makes only the external microphone operative. The radio may also be keyed with the push-to-talk switch on the radio itself, which makes only the internal microphone operative. (The internal push-to-talk switch overrides the external push-to-talk switch.) To transmit with the external microphone, follow the directions in paragraph f.

k. External Speaker-Microphone ("Universal" Models Only)

The speaker-microphone attaches to the radio in the same manner as the external microphone (see paragraph j.). The microphone and push-to-talk switch functions are also the same. To use the external speaker, place the INT-EXT speaker switch on EXT. (This switch is located on the upper wall in the battery compartment.) Incoming messages can now be heard on the external speaker in the speaker-microphone. The volume and squelch controls will function as before.

l. To Turn Off

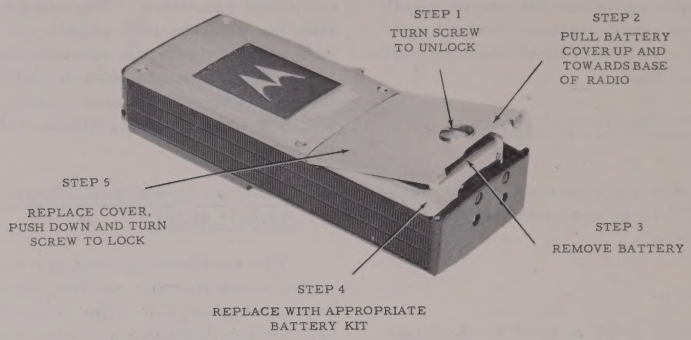
To turn the radio off, turn the volume control in the counterclockwise direction until a "click" is heard.

m. Storage

Remove the battery before storing the unit for a long period of time. If the radio is equipped with a nickel-cadmium battery see the storage instructions for the NLN6238A Battery Kit.

BATTERY REPLACEMENT AND CHARGING

1. BATTERY REPLACEMENT PROCEDURE



WARNING

Do not discard batteries in fire as they may explode.

NOTE

Place battery in battery compartment so the label may be read when the radio is held upright.

2. NLN6238A NICKEL CADMIUM BATTERY KIT

The NLN6238A Battery Kit, when used with an approved battery charger, provides a rechargeable source of d-c power for all models of the "Handie-Talkie" radio described in this manual. This kit consists of one 14.4 volt nickel-cadmium battery. The NLN6238A Nickel-Cadmium Battery kit is completely interchangeable with the NLN6239A Mercury Battery Kit (Mallory part number 303314).

a. General

The operational characteristics of a nickel-cadmium battery under load are rather unique. The load voltage remains approximately constant until the battery approaches the discharged condition. At this time, there is a marked decrease in the load voltage and the discharged condition is reached abruptly. It is difficult to determine the state of charge of this type battery with a meter, therefore, this is not normally performed.

The battery requires no special storage precautions; it may be stored in any condition of charge or discharge without detrimental effects such as sulphation in lead-acid storage batteries. However, for storage periods in excess of approximately six months, it is recommended that the battery be kept in a discharged state. A general characteristic of a rechargeable battery is self-discharge.

It is difficult to predict charge retention after extended periods of storage. If the battery is to be used on an emergency basis after unknown storage periods, it is recommended that is be initially charged for 16 hours at the full charging rate then trickle charged until need for the battery arises.

b. Charging

Because of the sealed construction, the battery does not require the addition of electrolyte during its service life. Hence, the major maintenance problems normally associated with rechargeable batteries are completely eliminated. Maintenance consists only of recharging the battery and keeping the battery and its contacts clean.

The sealed-cell construction of the battery requires that the charger be designed as an integral part of the overall system. This is very important because damage to the battery will result if overcharge is continued beyond certain limits. Only an approved charger (see ACCESSORY TABLE) can be used, otherwise the manufacturer's warranty covering the replacement of the battery during its service life is VOID.

CAUTION

Avoid accidental short circuits. Sustained high rate discharges will damage the battery.

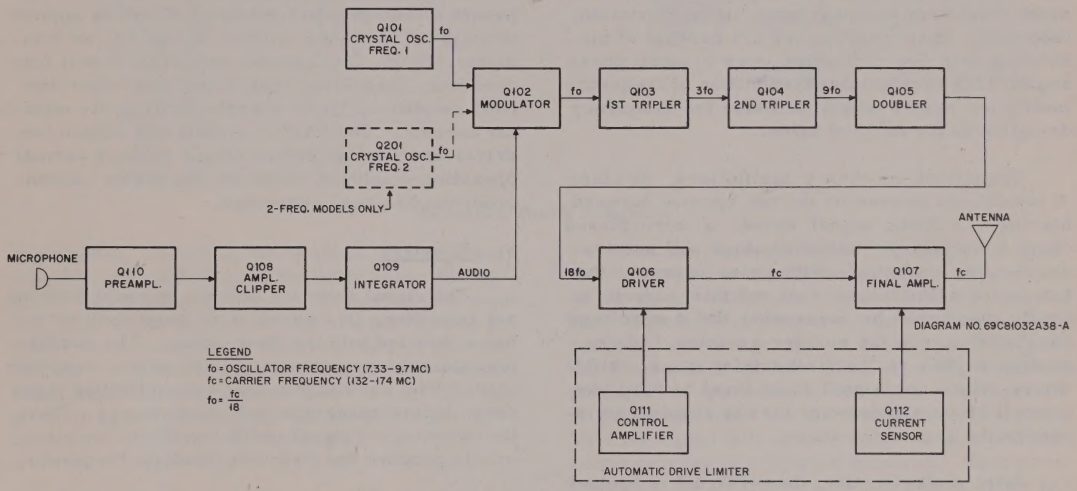
THEORY OF OPERATION

1. GENERAL

The "Handie-Talkie" radio consists of a crystal controlled transmitter and receiver operating in the 132-174 mc frequency range. The transmitter contains an audio section and an r-f section. The audio section consists of a dynamic microphone, an audio preamplifier, an amplifier-limiter, and an integrator stage. The r-f section consists of a crystal oscillator, a modulator, two frequency triplers, one frequency doubler, a driver amplifier, an intermediate power amplifier, and a final amplifier stage.

The receiver is a double conversion, superheterodyne unit consisting of one r-f amplifier, two oscillators, two mixers, one first i-f amplifier, five second i-f amplifiers, a 455 kc filter, a limiter, discriminator, squelch amplifier, noise rectifier and three audio amplifiers.

"Private-Line" tone-coded squelch models include additional stages, some of which are shared by both the transmitter and receiver. The common stages are a "Vibrasponder" resonant reed, two tone amplifier circuits and a "Vibrasponder" driver. High and low pass filters are unique to the receiver and a diode modulator is unique to the transmitter.



Transmitter Block Diagram

2. CIRCUIT THEORY

a. Transmitter

The dynamic microphone produces a low level audio output which is directly coupled to the preamplifier stage. The output from this stage is coupled to the amplifier-clipper stage.

The amplifier-clipper and integrator stages comprise an "Instantaneous Deviation Control" (IDC) circuit. Since the transmitter is phase modulated the frequency deviation is dependent upon both the amplitude and frequency of the audio signal applied to the modulator. The combination of the integrator and phase modulator results in a "flat" response being produced since the pre-emphasis characteristic of the phase modulator is offset by the de-emphasis of the integrator. Therefore, the frequency deviation of the modulator is dependent only upon the amplitude of the integrator input. The audio signal amplitude is limited in the amplifier-clipper prior to insertion into the integrator thereby limiting maximum deviation to a fixed value within the desired frequency range. Audio frequencies above 3000 cps are attenuated in a "splatter" filter, consisting of L116 and C114, prior to insertion into the integrator.

Oscillator stage Q101 (and Q201 in two frequency units) is a fundamental, crystal controlled, anti-resonant circuit. It generates a radio

frequency which is multiplied 18 times in succeeding stages to produce the desired carrier frequency. A variable capacitor across the crystal provides an adjustment (warping) of the operating frequency. The oscillator output is coupled to the modulator stage, Q102.

RF is applied to the base of modulator Q102 while audio is applied to the emitter. The internal r-f gain of Q102 is varied by (and at the rate of) the applied audio voltage. With a fixed phase shift circuit shunting the transistor and a variable phase shift being developed by the transistor, an overall variable phase shift is obtained at the output. The variable inductance in the output of the modulator stages allows matching of the output reactance of the stage to insure minimum distortion and maximum linear deviation. Generally, phase modulators are capable of modulating with low distortion over a small phase angle. This necessitates the addition of frequency multiplier stages which increase the frequency deviation to the desired value.

Transistor frequency multipliers, or class B amplifiers in general do not require forward biasing. Without signal drive, a zero-biased class B frequency multiplier stage will not draw any emitter current. With drive present, the transistor will draw current and this current is easily monitored by measuring the d-c voltage developed across the emitter resistor. An exception to this is the first tripler stage, Q103, where, since the signal input level is very low, a small amount of forward bias is supplied to increase the gain of the stage.

After multiplication, the r-f signal is applied to the driver-amplifier, Q106. This stage provides the proper r-f power to drive the final amplifier, Q107, to the rated power output level. A low pass filter reduces harmonic emissions from the r-f signal which is then coupled to the antenna.

The "Automatic Drive Limiter" ("ADL") protects the driver and final amplifier transistors (Q106 and Q107) from being damaged by excessive current. This condition can exist, if the transmitter is keyed with its resonant circuits misaligned, the output circuit shorted or the antenna removed.

In operation, transistor Q111 is normally conducting to saturation and Q112 normally cut off. Assume, for example, that the final amplifier, Q107, begins drawing excessive current due to a short in the output circuit. The current flow path for Q107 is from the power source, through choke L123 and resistor R138, to the emitter. As the current increases, the voltage at the junction of R138 and diode CR105 goes positive (i.e. less negative). Diodes CR104 and CR105 are normally conducting to saturation. As the potential at the junction of CR105 and R138 changes in the positive direction (due to the increase in the emitter current of Q107), it is coupled through CR105 and CR104 to the base of Q112 providing forward bias for the transistor causing it to conduct. As stated previously, Q111 is normally conducting to saturation. When Q112 starts conducting, it forms a low resistance path to the negative power source potential. This results in the forward bias of Q111 being reduced and a decrease in the transistors conduction. As the conduction of Q111 decreases, its collector will approach a less negative potential which is applied through L111 to the emitter of the driver transistor, Q106. The power gain of Q106 will now decrease, providing less drive power for the final amplifier, Q107, thereby limiting its emitter current. The "ADL" circuit will return the driver and final amplifier stages to their normal operating condition when the excessive current condition has been corrected.

b. Receiver

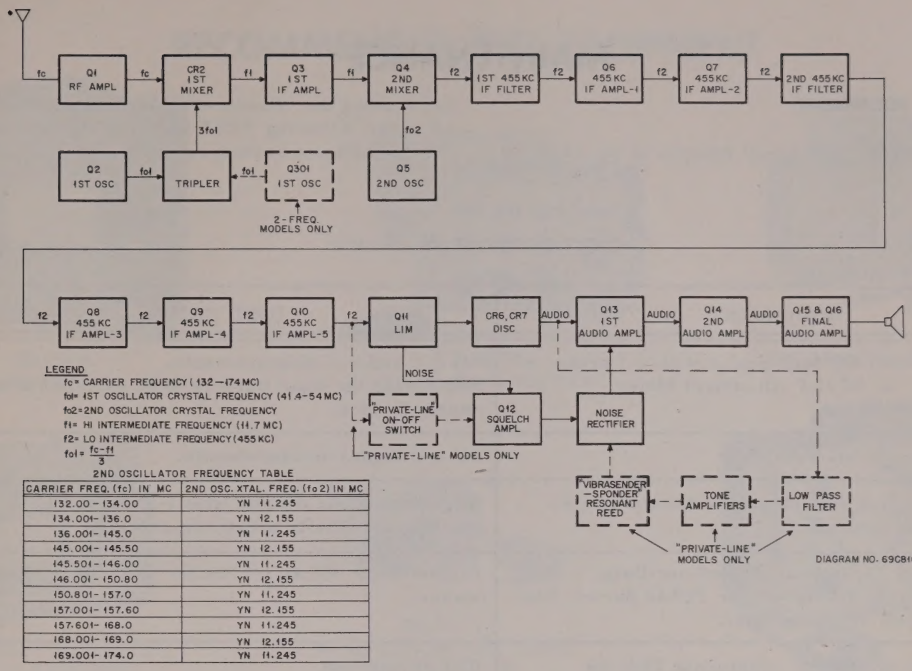
The signal from the antenna is coupled to the r-f amplifier, Q1, where it is amplified before being injected into the first mixer. The oscillator, Q2, is a crystal controlled, series-resonant type. The crystal frequency is multiplied three times before being injected into the mixer. There, the incoming r-f signal and the oscillator frequency mix to produce the first intermediate frequency.

The first i-f signal is amplified in the following stage, Q3, and fed to the second mixer. The second mixer combines the first i-f signal and the output of the 2nd oscillator to produce the second i-f signal of 455 kc.

The 455 kc signal is selected in the first section of the "Permakay" filter, amplified in the two following stages, Q6 and Q7, and selected again in the second section of the "Permakay" filter. The 455 kc signal is then amplified in the next three stages.

The limiter stage (Q11) removes any AM noise present on the incoming signal. The discriminator translates the variations of frequency of the i-f signal to an audio frequency signal which is then coupled to the first audio amplifier.

Squelch action is provided by taking the noise produced at the supply voltage decoupling point of



LEGEND
fc = CARRIER FREQUENCY (132—174 MC)
fo1 = 1ST OSCILLATOR CRYSTAL FREQUENCY (41.4-54 MC)
fo2 = 2ND OSCILLATOR CRYSTAL FREQUENCY
f1 = HI INTERMEDIATE FREQUENCY (11.7 MC)
f2 = LO INTERMEDIATE FREQUENCY (455 KC)
$fo1 = \frac{fc - f1}{3}$

2ND OSCILLATOR FREQUENCY TABLE

CARRIER FREQ. (fc) IN MC	2ND OSC. XTAL. FREQ. (fo2) IN MC
132.00 - 134.00	YN 11.245
134.001- 136.0	YN 12.155
136.001- 145.0	YN 11.245
145.001- 145.50	YN 12.155
145.501- 146.00	YN 11.245
146.001- 150.80	YN 12.155
150.801- 157.0	YN 11.245
157.001- 157.60	YN 12.155
157.601- 168.0	YN 11.245
168.001- 169.0	YN 12.155
169.001- 174.0	YN 11.245

Receiver Block Diagram

the limiter, removing the residual 455 kc signal, amplifying that portion of the noise above the normal voice frequency range, rectifying this noise and applying it as positive bias to the base of the audio output stage. In the event the r-f carrier is lost, the positive bias cuts off the audio output stage and eliminates the speaker noise. The degree of squelch action is regulated by a potentiometer.

The audio section consists of three amplifier stages which amplify the recovered audio to 500 milliwatts. The first two stages are directly coupled so that when the first stage is back biased by the squelch rectifier circuit, the second stage (driver) is also turned off. Since the third stage is class B and its current drain is minimal with no signal being fed to it, the audio drain under standby conditions is negligible.

c. "Private-Line" Tone-Coded Transmitters and Receivers

The controlling element in the "Private-Line" circuit is the "Vibrasponder" unit. The unit acts similar to a control crystal in an oscillator stage. When the transmitter is keyed, a resonant reed inside the unit vibrates at a pre-determined frequency. The resulting tone is then amplified by tone amplifiers and fed into the modulator circuit, Q102. It is then coupled, with the audio signal, to modulate the oscillator frequency.

With the "Private-Line" switch in the OFF position, the receiver squelch action is performed as in any standard, noise-operated squelch unit. Moving the "Private-Line" switch to the ON position injects a portion of the 455 kc i-f signal into the squelch circuit. The signal is amplified, rectified and applied as positive bias to the emitter of the audio input stage, cutting the stage off. This i-f signal will always be present, even when an r-f carrier is not being received. Therefore, whenever the "Private-Line" switch is in the ON position, and a properly coded r-f carrier is not being received, the audio stages will be cut off.

When a properly coded "Private-Line" carrier comes on the air, the tone signal is sent to the "Private-Line" circuitry where it is amplified, detected, and coupled to drive the "Vibrasponder" unit. The "Vibrasponder" resonant reeds used in these "Handie-Talkie" radios are of the two coil, single tine type. When a tone is applied across the input coil at the reed mechanical resonant frequency, the reed will vibrate strongly, acting as an electro-mechanical coupling between the input and output coil. Therefore the reed can be considered to be a very narrow bandpass filter which passes only the desired tone.

The signal from the "Vibrasponder" unit output coil is then detected and applied as negative bias to the emitter of the audio input stage, allowing it to conduct and unsquelch the audio amplifiers. In dual squelch receivers the squelch sensitivity is never greater than the tone-coded squelch sensitivity.

MAINTENANCE

1. TEST EQUIPMENT

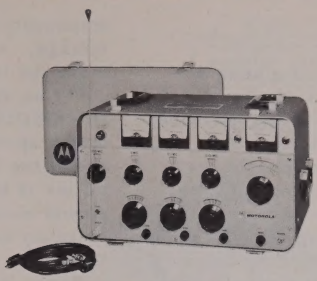
All the required test equipment for aligning and testing the "Handie-Talkie" FM radio is listed in the following TEST EQUIPMENT CHART. The listed items or their equivalent may be used.

TEST EQUIPMENT CHART

EQUIPMENT	USED FOR
Motorola DC Multimeter with r-f probe or TEK-7A DC/RF Alignment Meter	All d-c and r-f measurements. Monitoring the input current when external power supply is used.
Motorola AC Voltmeter	All a-c signal measurements.
FM signal generator - Motorola T1034C Signal Generator.	Alignment of all r-f and first i-f stages, 20 db quieting sensitivity measurements.
455 kc crystal-controlled oscillator - Motorola S1056A, 9A or TU546 Series Test Set with 455 kc crystal.	Alignment of 455 kc i-f limiter and discriminator stages.
Audio generator - Motorola TEK-1A Transistorized Tone Generator, 1000 cps. Motorola T1130A Series FM Station Monitor (or equivalent)	IDC Adjustment
Oscilloscope - Motorola T1015A General Purpose Oscilloscope or Motorola T1014B Precision Wide Band Oscilloscope. S1058A Test Set (Includes deviation meter).	IDC Adjustment
Model 61 RF Wattmeter	All r-f output power measurements.
Motorola NLN6245A Alignment Tool Kit (supplied with the radio).	Adjusting the variable capacitors and tuning coil slugs.
Motorola NEN6049A Test Jig	Holding the radio for alignment or testing, keeping the push-to-talk button depressed, applying external power.
DC power supply. Motorola TEK-23 Power Supply (or equivalent, capable of supplying -14 volts d-c at 400 ma).	Supplying d-c power to the unit during extended servicing.

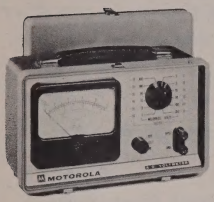
RECOMMENDED TEST EQUIPMENT

S1059A
TEST SET

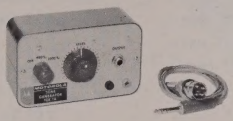


T1021B
FREQUENCY METER

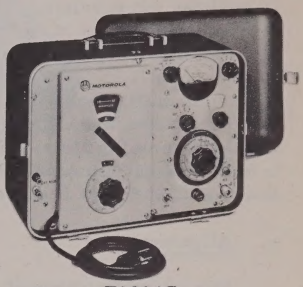
DC MULTIMETER



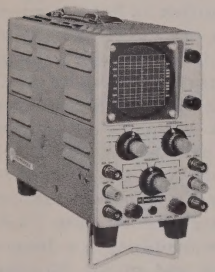
TRANSISTORIZED AC
VOLTMETER



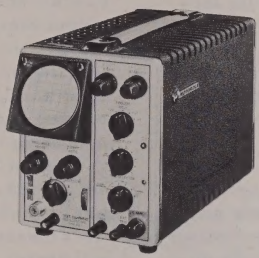
TEK-1A
TRANSISTORIZED TONE
GENERATOR



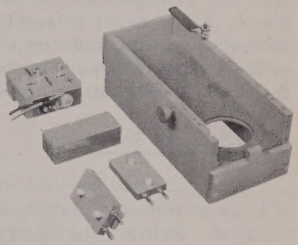
T1034C
SIGNAL GENERATOR



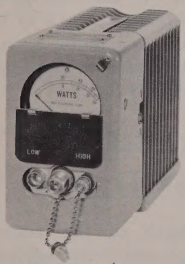
T1015A
GENERAL PURPOSE
OSCILLOSCOPE



T1041B
PRECISION WIDE BAND
OSCILLOSCOPE

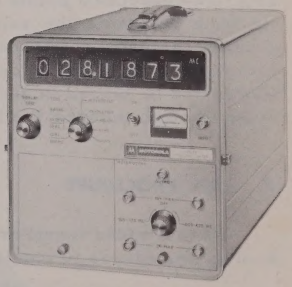


NEN6049A
TEST JIG



MODEL 61
RF WATTMETER

TEK-23
POWER SUPPLY



T1075A DIGITAL
FREQUENCY METER

2. USE OF THE TEST JIG

The Motorola NEN6049A Test Jig holds the FM "Handie-Talkie" radio while testing or aligning the unit. Normally, the radio is aligned in the test jig with the self-contained batteries used as the power source. When the radio must be operated in the test jig for extended periods, the battery should be removed and the unit powered from an external source. A dummy battery, including power leads and polarity protection diode, is supplied with the test jig. A yoke is supplied to hold the receiver or the transmitter circuit board in position for servicing. The test jig includes a screw-type knob to keep the push-to-talk button depressed for keying the transmitter.

The small spacing block supplied with the test jig is used when servicing the internal microphone (only) models. The "Universal" (external/internal microphone) models have longer housings and do not require this block.

a. Alignment

For normal alignment procedure, the battery can be left in the radio housing to power the unit. The unit is placed in the test jig face down. Refer to the alignment procedure for a photograph of the radio in the test jig. The knob on the test jig is turned clockwise to press against the push-to-talk button for keying the transmitter.

b. Extended Servicing

For extended periods of servicing or testing, it is recommended that an external power source be used. Remove the battery cover and battery from the battery compartment. Place the dummy battery in the unit. Make sure both contacts on the dummy battery make contact with their respective connection points on the radio. The test jig knob performs the same function as above. Connect the proper external power source to the test jig. It is recommended that a 0-500 d-c milliammeter be placed in series with the negative power lead to monitor the total input current.

3. TEST PROCEDURE

When a radio requires servicing, use the following procedures to localize the fault.

a. Check Batteries

The first step in localizing the trouble is to check the battery voltage under load. With the transmitter turned on (keyed), check the battery voltage. A convenient way to do this is to remove the battery cover and radio compartment cover as shown in paragraph 4. DISASSEMBLY PROCEDURE. Place the voltmeter ground lead on the speaker ground lug and measure the voltage at the transmitter A- input while the transmitter is keyed. The measured loaded voltage should be not less than 12 volts for either the mercury or nickel-cadmium batteries. Even though the transmitter may operate at this lower voltage, its operation would be marginal and for only a short additional period of time. The recommended procedure is to replace, or recharge, the batteries if the voltage is below 12 volts under load. Refer to the BATTERY REPLACEMENT AND CHARGING section of this manual for additional information.

NOTE

Only the nickel-cadmium batteries are rechargeable.

b. Check Overall Transmitter Operation

If the battery voltage is sufficient, check the overall performance of the transmitter. A good overall check of the transmitter is the r-f power output measurement. This one check indicates the proper operation of all the transmitter stages (oscillator, frequency multipliers, driver and final amplifier) with the exception of the modulator and audio circuitry. A properly tuned and operating transmitter will produce at least 1.7 w r-f output into a 50-ohm load with a d-c input of 14.2 volts. It may be necessary to retune the output circuits slightly to match the 50-ohm load. This measurement should be made using a 50-ohm wattmeter connected to one end of the 50-ohm test cable with the other end connected to the external antenna jack.

For further details, refer to the transmitter alignment procedure. If the power output is less than 1.7 w with a d-c input voltage of 14.2 volts, further checking is required. Refer to paragraph 6. TRANSMITTER SERVICE NOTES.

c. Check Overall Receiver Operation

(1) 20 DB Quieting Sensitivity Check

A good overall check of the receiver operation is the 20 db quieting sensitivity measurement. This check will indicate that the receiver has sufficient gain and that all the included circuitry is working properly. The quieting signal is that r-f signal input necessary to reduce the

CEDURE

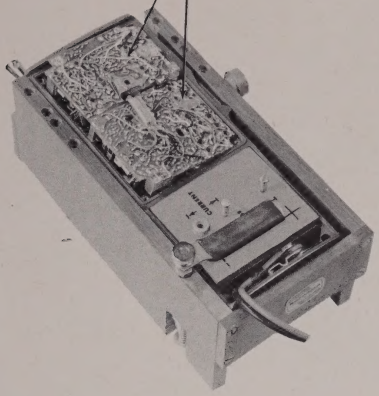
TEP 2

TTERY COMPART-
R BY LIFTING UP
DS BOTTOM.

CEIVER
ENTER
R AS

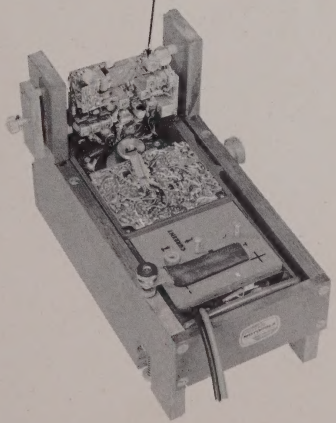
STEP 6

LIFT BOTH BOARDS SLIGHTLY TO CLEAR INTERCABLING



STEP 7B

FOR TRANSMITTER SERVICING: LIFT TRANSMITTER VERTICALLY. MOUNT TEST BRIDGE IN MOUNTING HOLES NEAREST TOP OF RADIO. ROTATE THE TRANSMITTER AND MOUNT IN POSITION SHOWN.



REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

PARTS LIST for Intercabling Diagram 63D81023A83-D

NHN6101A Housing Kit (1-Freq. Xmtr, & 1-Freq. Rcvr.)
NHN6102A Housing Kit (2-Freq. Xmtr, & 2-Freq. Rcvr.)
NHN6103A Housing Kit (2-Freq. Xmtr, & 1-Freq. Rcvr.)

EPD-10777-A

F1	65B82896B02	FUSE, cartridge: 1 AMP, 125 v
J1, 2	9C82684D01	JACK, receptacle: does not incl. 15A82688D01 COVER, jack
J3	1V80738A13	7 contact
K1	80C82675H01	RELAY, armature: 2 form "C"; coil res. 280 ohms
L16, 17, 18, 19, 20	24C82723H01	COIL, RF choke: 1.2 uh
LS1	50D82660D01	SPEAKER, dynamic: coil imped. 50 ohms; 2-1/4" dia; weatherproof
MK1	50C82162D01	MICROPHONE, magnetic: imped. 1650 ohms at 1 kc
R40	18C82662D01	RESISTOR, fixed: unl stated var: 10K; 0.12 w; weatherproof incl ref. part S2
R41	6K129662	180 ±10%; 1/4 w
R42	18C83669A01	var: 5K ±10%; 0.12 w
R56	6R2085	39 ±10%; 1/2 w
R65	6R129753	100 ±10%; 1/4 w
R70	6R127802	1K ±10%; 1/4 w
S1	1V80733A90	SWITCH, push: assy; incl. 40C82957G01 switch, push: 2 form "C" contacts; (spring return)
S2		spst; p/o R40
S3	40B82089H01 or40B82090H01	SWITCH, toggle: dpdt (NHN6102A) spdt (NHN6103A)
S4	40C82009H01	SWITCH, slide: contacts, 1 form "2"; used as spdt; does not include 11M32626 TUBING, heat shrink: No. 18 clear; (specify length required)
		NON-REFERENCED ITEMS
	1V80738A09	HOUSING ASSY: part of NHN6101A
	1V8073A10	HOUSING ASSY: part of NHN6102A and NHN6103A
	36C82659D01	KNOB, switch
	35A82654D01	DIAPHRAGM, microphone
	15B82651D01	COVER, microphone
	36B82681E03	KNOB, control
	36B82681E01	KNOB
	38B82657D01	BUTTON, push

NAD6160A Antenna Tilted (132-174 MC) EPD-10780-O

	47B82097H01	ROD, antenna; (132-174 MC)
	43A847577	BALL, antenna rod
	2A82096H01	NUT, knurled

NLN6331A Rear Cover Kit EPD-10781-O

	1V80733A54	REAR COVER ASSY.
	1V80723A36	BATTERY COVER ASSY.
	4C82418B09	WASHER, nylon: 4 req'd
	3A82210E01	SCREW: special type; 4 req'd

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

NSN6008A Lapel Speaker Kit EPD-10782-O

	50C82149E01	SPEAKER, lapel: voice coil imped. 15 ohms; 2-1/2" dia.
	30B82580D02	CABLE AND PLUGS ASSY.

NSN6009A Earpiece Kit EPD-10783-A

	50C82151E01	EARPIECE
	30B82150E01	CABLE AND PLUGS ASSY.

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

"Plug-In" Microphones

Conventional Type
NMN6023A (coiled cord)
NMN6024A (straight cord)

Noise-Cancelling Type
NMN6027A (straight cord)
NMN6028A (coiled cord)

EPD-11677-O

C501	8C82396B07	CAPACITOR, fixed: .05 uf ±20%; 50 v (NMN6027A & NMN6028A only)
DP501	59C82960G01	CARTRIDGE: microphone: reluctance type (NMN6023A & NMN6024A)
	or59C83361B01	reluctance type (NMN6027A & NMN6028A)
P501		CONNECTOR, plug: c/o the following items: 1V80738A33 PLUG ASSY: fem. 7 cont 15C82683H01 SHELL 42B82682H01 CLAMP, cable 3S122924 SCREW, machine: 4-40 x 1/4" Phillips round head; 2 req'd 4S9743 LOCKWASHER: No. 4 split; 2 req'd 2B82681H01 NUT, machine: (retaining ring) 37B82324G01 SLEEVE, cord, strain relief 3S120421 SETSCREW; 4-40 x 1/8" Allen hd; cup type 2 req'd
R501	6S129753	RESISTOR, fixed: 100 ±10%; 1/4 w (NMN6027A & NMN6028A only)
S501	40C82863E01	SWITCH, push: spst no; does not incl 3S129172 SCREW, machine: 3-48 x 3/8" slotted binder hd; 2 req'd
W501	1V80738A36	CORD & PLUG ASSY., micro-phone: incl P501 and 30D82565B21 CORD, microphone: coiled type; 4 conductor (NMN6023A & NMN6028A)
	or1V80738A37	incl P501 and 30B82285H01 CORD, microphone: straight type; 5 conductor; shielded; 28" length req'd (NMN6024A & NMN6027A)
		NON-REFERENCED ITEMS
	15C82829E01	HOUSING (front)
	1V80748A50	HOUSING (rear) (NMN6023A & NMN6024A)
	or1V80750A12	HOUSING (rear) (NMN6027A & NMN6028A)
	41B82856E01	SPRING, backup
	38B82833E01	PUSHBUTTON
	35A82853E01	DIAPHRAGM, microphone pro-tector
	4C82418B22	WASHER, insulating
	75A82852E01	PAD, rubber, 1.24" dia.
	75A82192A02	PAD, rubber: 0.562" dia.
	64A82826E01	PLATE, tapped
	7B82801E01	BRACKET, hold-down (NMN6023A & NMN6024A)
	or 7B82801E03	BRACKET, hold-down (NMN6027A & NMN6028A)
	32A82661C02	GASKET (NMN6023A & NMN6024A)
	or32A82661C03	GASKET (NMN6027A & NMN6028A)
	42B82831E01	CLAMP, cable
	1V80727A18	SPRING & BUSHING ASSY.
	1V80727A20	BOARD (eyeleted)

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

SPEAKER-MICROPHONES (external)
NMN6021A (coiled cord)
NMN6022A (straight cord)

EPD-10779-A

DP601	50C82162D01	CARTRIDGE, microphone: magnetic type: does not incl. 75A82153D01 PAD, rubber (front) 75B82154D01 PAD, rubber (rear)
LS601	50D82660D01	LOUDSPEAKER, permanent magnet: 2-1/4" weatherproof; 50 ohms imped.
P601		CONNECTOR, plug: consists of the following items: 1V80738A33 PLUG ASSEMBLY: female; 7 contact 15C82683H01 SHELL 42B82682H01 CLAMP, cable 3S122924 SCREW, machine: 4-40 x 1/4" Phillips round head; 2 req'd 4S9743 LOCKWASHER: No. 4 split; 2 req'd 2B82681H01 NUT, machine: (retaining ring) 37B82324G01 SLEEVE, cord strain relief 3S120421 SETSCREW: 4-40 x 1/8" Allen hd; cup type; 2 req'd
S601	40C82853E01	SWITCH, push; spst no; does not incl. 3S129172 SCREW, machine: 3-48 x 3/8" slotted binder hd; 2 req'd
W601	1V80738A32	CORD & PLUG ASSY.; micro-phone: incl P601 and 30D82565B22 CORD, microphone: coiled type; 5 cond.(NMN6021A)
	or1V80738A34	incl P601 and 30B82285H01 CORD, microphone: straight type: 5 cond. shld 45" lgth reqd (NMN6022A)
		NON-REFERENCED ITEMS
	15C82822H01	HOUSING, (front)
	1V80738A31	HOUSING, (rear)
	3S132731	SCREW, machine: 4-40 x 9/16" Phillips binder head; 4 req'd
	4S9743	LOCKWASHER: No. 4 split; 6 req'd
	4B82650D06	WASHER: 4 req'd
	38B82829H01	PUSHBUTTON
	41B82856E01	SPRING, backup
	38B82680D01	SPRING, coil
	64A82826E01	PLATE, tapped
	64A82824H01	PLATE, hold-down
	3S132523	SCREW, tapping: No. O x 5/32" slotted binder hd; 2 req'd
	32A82825H01	GASKET: (rubber)
	42A82826H01	CLAMP, cable
	43A82685D01	SPACER
	1V80727A20	BOARD (eyeleted)
	35A8258D02	CLOTH, grille

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

"Plug-In" Microphones

Conventional Type
NMN6023B (coiled cord)
NMN6024B (straight cord)

Noise-Cancelling Type
NMN6027B (straight cord)
NMN6028B (coiled cord)

EPD-13444-O

C501	8C82396B07	CAPACITOR, fixed: .05 uf ±20%; 50 v (NMN6027B & NMN6028B only)
DP501	59C82960G01	CARTRIDGE: microphone: reluctance type (NMN6023B & NMN6024B)
	or59C83361B01	reluctance type (NMN6027B & NMN6028B)
P501		CONNECTOR, plug: c/o the following items: 1V80755A89 PLUG ASSY: fem. 7 cont. 15C83261C01 SHELL 42B83262C01 CLAMP, cable 3S122924 SCREW, machine: 4-40 x 1/4" Phillips round head; 2 req'd 4S9743 LOCKWASHER: No. 4 split; 2 req'd 2B82681H03 NUT, machine: (retaining ring) 37A868208 SLEEVE, cord, strain relief 3S120421 SET-SCREW: 4-40 x 1/8" Allen hd; cup type 2 req'd
R501	6S129753	RESISTOR, fixed: 100 ±10%; 1/4 w (NMN6027B & NMN6028B only)
S501	40C82863E01	SWITCH, push: spst no; does not incl. 3S129172 SCREW, machine: 3-48 x 3/8" slotted binder hd; 2 req'd
W501	1V80757A98	CORD & PLUG ASSY., micro-phone: incl. P501 and 30D82565B21 CORD, microphone: coiled type; 4 cond, (NMN6023B & NMN6028B)
	or 1V80755A92	incl. P501 and 30B82285H01 CORD, microphone: straight type; 5 cond.; shielded; 28" length req'd (NMN6024B & NMN6027B)
		NON-REFERENCED ITEMS
	15C82828E01	HOUSING (front)
	1V80748A50	HOUSING (rear) (NMN6023B & NMN6024B)
	or 1V80750A12	HOUSING (rear) (NMN6027B & NMN6028B)
	41B82856E01	SPRING, backup
	38B82833E01	PUSHBUTTON
	35A82853E01	DIAPHRAGM, microphone pro-tector (2 req'd for NMN6027B & NMN6028B)
	4C82418B22	WASHER, insulating
	75A82852E01	PAD, rubber, 1.24" dia.
	75A82192A02	PAD, rubber, 0.562" dia.
	64A82826E01	PLATE, tapped
	7B82801E01	BRACKET, hold-down (NMN6023B & NMN6024B)
	or 7B82801E03	BRACKET, hold-down (NMN6027B & NMN6028B)
	32A82661C02	GASKET (NMN6023B & NMN6024B)
	or32A82661C03	GASKET (NMN6027B & NMN6028B)
	42B82831E01	CLAMP, cable
	1V80727A18	SPRING & BUSHING ASSY.
	1V80727A20	BOARD (eyeleted)

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

SPEAKER-MICROPHONES (external)
NMN6021B (coiled cord)
NMN6022B (straight cord)

EPD-13445-O

DP601	50C82162D01	CARTRIDGE, microphone: magnetic type: does not incl. 75A82153D01 PAD, rubber (front) 75B82154D01 PAD, rubber (rear)
LS601	50D82660D01	LOUDSPEAKER, permanent magnet: 2-1/4" weatherproof; 50 ohms imped.
P601		CONNECTOR, plug: c/o the following items: 1V80755A89 PLUG ASSY: fem. 7 cont. 15C83261C01 SHELL 42B83262E01 CLAMP, cable 3S122924 SCREW, machine: 4-40 x 1/4" Phillips round hd; 2 req'd 4S9743 LOCKWASHER: No. 4 split; 2 req'd 2B82681H03 NUT, machine: (retaining ring) 37A868208 SLEEVE, cord strain relief 3S120421 SET-SCREW: 4-40 x 1/8" Allen hd; cup type; 2 req'd
S601	40C82863E01	SWITCH, push: spst no; does not incl. 3S129172 SCREW, machine: 3-48 x 3/8" slotted binder hd; 2 req'd
W601	1V80757A97	CORD & PLUG ASSY.; micro-phone: incl. P601 and 30D82565B22 CORD, microphone: coiled type; 5 cond. (NMN6021B)
	or 1V80755A91	incl. P601 and 30B83980B01 CORD, microphone: straight type; 5 cond. shld 45" lgth req'd (NMN6022B)
		NON-REFERENCED ITEMS
	15C82822H01	HOUSING, (front)
	1V80738A31	HOUSING, (rear)
	3S132731	SCREW, machine: 4-40 x 9/16" Phillips binder head; 4 req'd
	4S9743	LOCKWASHER: No. 4 split; 6 req'd
	4B82650D06	WASHER: 4 req'd
	38B82829H01	PUSHBUTTON
	41B82856E01	SPRING, backup
	38B82680D01	SPRING, coil
	64A82826E01	PLATE, tapped
	64A82824H01	PLATE, hold-down
	3S135369	SCREW, tapping: No. 0-48 x 3/16" slotted binder hd; 2 req'd
	32A82825H01	GASKET; (rubber)
	42A82826H01	CLAMP, cable
	43A82685D01	SPACER
	1V80727A20	BOARD (eyeleted)
	35A8258D02	CLOTH, grille

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
SPEAKER-MICROPHONES (external) NMN6021B (coiled cord) NMN6022B (straight cord)		EPD-13445-O
DP601	50C82162D01	CARTRIDGE, microphone: magnetic type; does not incl. 75A82153D01 PAD, rubber (front) 75B82154D01 PAD, rubber (rear)
LS601	50D82660D01	LOUDSPEAKER, permanent magnet: 2-1/4" weatherproof; 50 ohms imped.
P601		CONNECTOR, plug: c/o the following items: 1V80755A89 PLUG ASSY: fem. 7 cont. 15C83261C01 SHELL 42B83262C01 CLAMP, cable 3S122924 SCREW, machine: 4-40 x 1/4" Phillips round hd; 2 req'd 4S9743 LOCKWASHER: No. 4 split; 2 req'd 2B82681H03 NUT, machine: (retaining ring) 37A868208 SLEEVE, cord strain relief 3S120421 SET-SCREW: 4-40 x 1/8" Allen hd; cup type; 2 req'd
S601	40C82863E01	SWITCH, push: spst no; does not incl. 3S129172 SCREW, machine: 3-48 x 3/8" slotted binder hd; 2 req'd
W601	1V80757A97 or 1V80755A91	CORD & PLUG ASSY.; microphone: incl. P601 and 30D82565B22 CORD, microphone: coiled type; 5 cond, (NMN6021B) incl. P601 and 30B83980B01 CORD, microphone: straight type; 5 cond. shld 45" lgth req'd (NMN6022B)
NON-REFERENCED ITEMS		
	15C82822H01	HOUSING, (front)
	1V80738A31	HOUSING, (rear)
	3S132731	SCREW, machine: 4-40 x 9/16" Phillips binder head; 4 req'd
	4S9743	LOCKWASHER: No. 4 split; 6 req'd
	4B82650D06	WASHER: 4 req'd
	38B82829H01	PUSHBUTTON
	41B82856E01	SPRING, backup
	38B82680D01	SPRING, coil
	64A82826E01	PLATE, tapped
	64A82824H01	PLATE, hold-down
	3S135369	SCREW, tapping: No. 0-48 x 3/16" slotted binder hd; 2 req'd
	32A82825H01	GASKET: (rubber)
	42A82826H01	CLAMP, cable
	43A82685D01	SPACER
	1V80727A20	BOARD (eyeleted)
	35A82258D02	CLOTH, grille

audio output at the speaker by 20 decibels. The measurement should be made in the absence of extraneous signals. Since the receiver squelch circuitry reduces the noise at the speaker, the squelch control should be set for maximum noise while making this measurement.

The actual measurement is made by observing the noise voltage at the external speaker jack on an a-c voltmeter with no r-f signal received at the antenna. Sufficient carrier signal from a recommended signal generator is then introduced via the external antenna jack to reduce the noise output voltage to 1/10 of the previous reading. If all circuitry is operating properly, the quieting signal should be 0.5 microvolt or less.

(2) Squelch Check

With no r-f input signal, sets the squelch control until the speaker noise just cut out (threshold squelch). Sufficient carrier signal from a recommended signal generator is then introduced until speaker noise is just heard. The signal level at which the squelch begins to open should be less than one-half the 20 db quieting sensitivity voltage measured in subparagraph (1).

(3) Audio Check

The last check to be made is the audio check. This procedure will test the audio circuits exclusive of the squelch circuitry. Refer to the AUDIO AMPLIFIER MEASUREMENTS CHART, which appears later in this manual, for typical measurements and procedures.

4. DISASSEMBLY PROCEDURE

To gain access to the component side of the chassis, follow the procedure as indicated in the following illustrations. To reassemble the radio, reverse Steps 1 through 7.

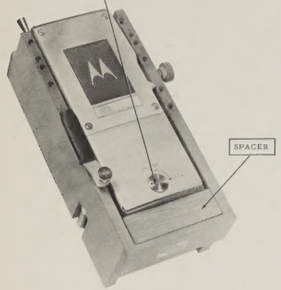
NOTE

To aid circuit tracing, the components side of the circuit board is screened in the pattern of the etched circuitry. This paint does not conduct and has no electrical function.

DISASSEMBLY PROCEDURE

STEP 1

PLACE RADIO IN TEST JIG. INSERT SPACER BLOCK (INTERNAL MIC. ONLY MODELS). UNLOCK BATTERY COMPARTMENT COVER.

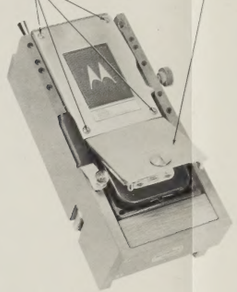


STEP 3

LOOSEN THE FOUR CAPTIVE SCREWS AND REMOVE RADIO COMPARTMENT COVER.

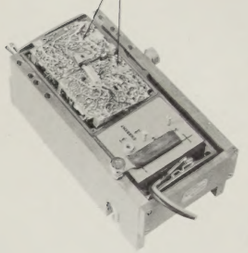
STEP 2

REMOVE BATTERY COMPARTMENT COVER BY LIFTING UP AND TOWARDS BOTTOM.



STEP 6

LIFT BOTH BOARDS SLIGHTLY TO CLEAR INTERCABLING

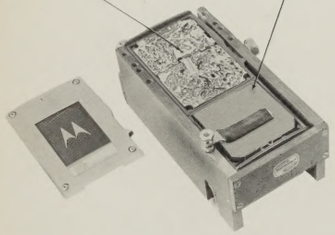


STEP 5

IF ACCESS TO THE COMPONENT SIDE OF THE PRINTED CIRCUIT BOARD IS REQUIRED, REMOVE THE SCREW HOLDING THE TRANSMITTER BOARD TO THE SPEAKER.

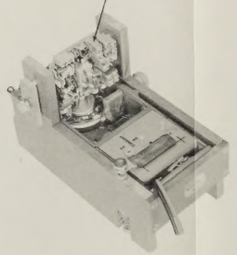
STEP 4

ALL NORMAL TUNING ADJUSTMENTS MAY NOW BE MADE. (SEE ALIGNMENT PROCEDURE.) IF EXTENSIVE TESTING IS REQUIRED REPLACE THE BATTERY WITH A DUMMY BATTERY (P/O TEST JIG) AND EXTERNAL POWER SUPPLY.



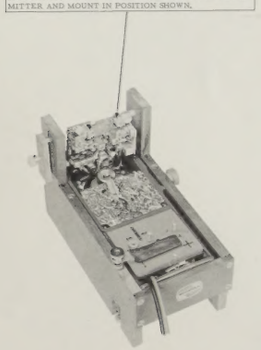
STEP 7A

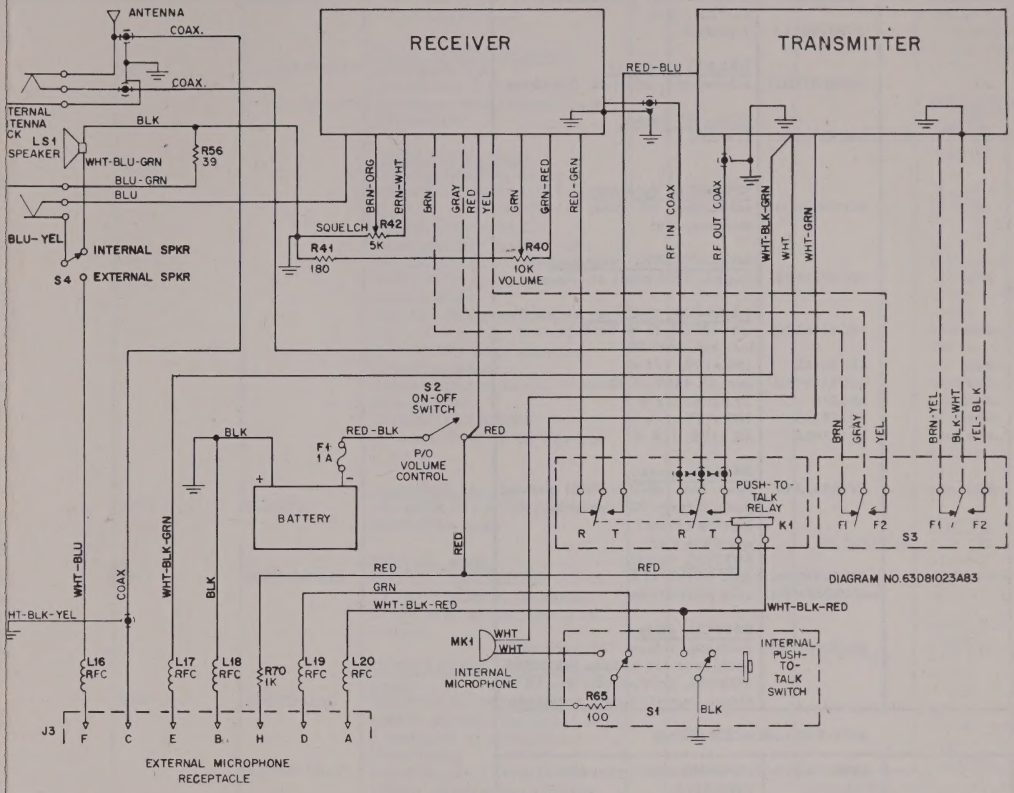
FOR RECEIVER SERVICING: LIFT THE RECEIVER VERTICALLY. PLACE TEST BRIDGE IN CENTER MOUNTING HOLES AND MOUNT RECEIVER AS SHOWN.



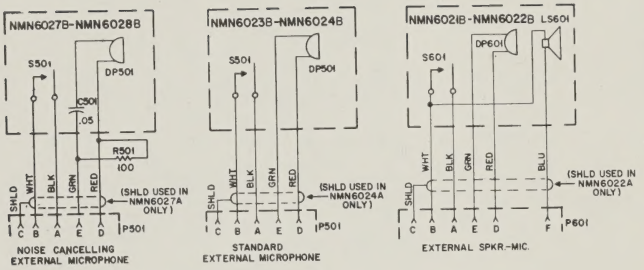
STEP 7B

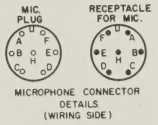
FOR TRANSMITTER SERVICING: LIFT TRANSMITTER VERTICALLY. MOUNT TEST BRIDGE IN MOUNTING HOLES NEAREST TOP OF RADIO. ROTATE THE TRANSMITTER AND MOUNT IN POSITION SHOWN.

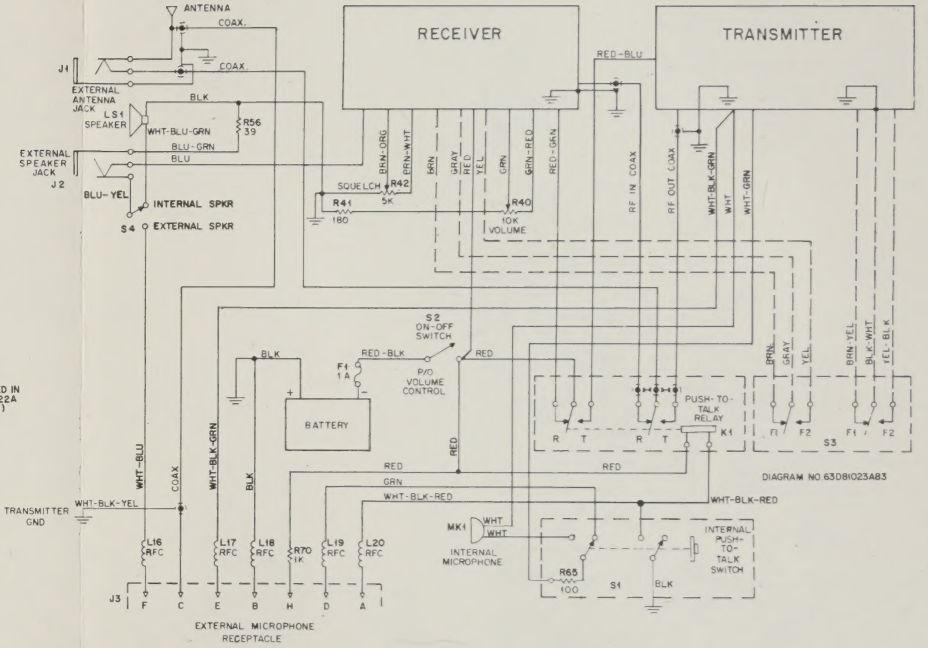




Carrier Squelch "Universal" Models
With External/Internal Microphone
Intercabling Diagram
Motorola No. 63D81023A83-D







Carrier Squelch "Universal" Models
With External/Internal Microphone
Intercabling Diagram
Motorola No. 63D81023A83-D

2. USE OF THE TEST JIG

The Motorola NEN6049A Test Jig holds the FM "Handie-Talkie" radio while testing or aligning the unit. Normally, the radio is aligned in the test jig with the self-contained batteries used as the power source. When the radio must be operated in the test jig for extended periods, the battery should be removed and the unit powered from an external source. A dummy battery, including power leads and polarity protection diode, is supplied with the test jig. A yoke is supplied to hold the receiver or the transmitter circuit board in position for servicing. The test jig includes a screw type knob to keep the push-to-talk button depressed for keying the transmitter.

The small spacing block supplied with the test jig is used when servicing the internal microphone (only) models. The "Universal" (external/internal microphone) models have longer housings and do not require this block.

a. Alignment

For normal alignment procedure, the battery can be left in the radio housing to power the unit. The unit is placed in the test jig face down. Refer to the alignment procedure for a photograph of the radio in the test jig. The knob on the test jig is turned clockwise to press against the push-to-talk button for keying the transmitter.

b. Extended Servicing

For extended periods of servicing or testing, it is recommended that an external power source be used. Remove the battery cover and battery from the battery compartment. Place the dummy battery in the unit. Make sure both contacts on the dummy battery make contact with their respective connection points on the radio. The test jig knob performs the same function as above. Connect the proper external power source to the test jig. It is recommended that a 0-500 d-c milliammeter be placed in series with the negative power lead to monitor the total input current.

3. TEST PROCEDURE

When a radio requires servicing, use the following procedures to localize the fault.

a. Check Batteries

The first step in localizing the trouble is to check the battery voltage under load. With the transmitter turned on (keyed), check the battery voltage. A convenient way to do this is to remove the battery cover and radio compartment cover as shown in paragraph 4. DISASSEMBLY PROCEDURE. Place the voltmeter ground lead on the speaker ground lug and measure the voltage at the transmitter A- input while the transmitter is keyed. The measured loaded voltage should be not less than 12 volts for either the mercury or nickel-cadmium batteries. Even though the transmitter may operate at this lower voltage, its operation would be marginal and for only a short additional period of time. The recommended procedure is to replace, or recharge, the batteries if the voltage is below 12 volts under load. Refer to the BATTERY REPLACEMENT AND CHARGING section of this manual for additional information.

NOTE

Only the nickel-cadmium batteries are rechargeable.

b. Check Overall Transmitter Operation

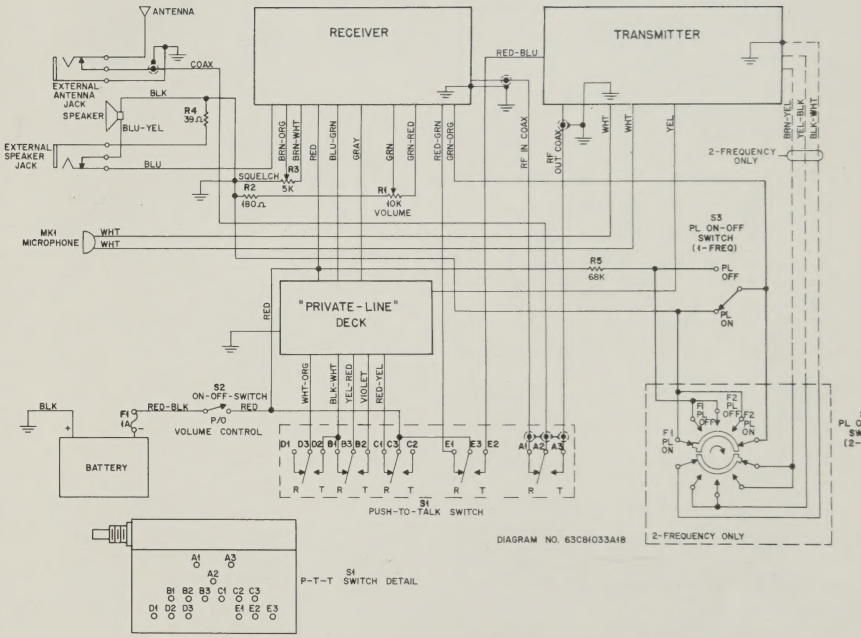
If the battery voltage is sufficient, check the overall performance of the transmitter. A good overall check of the transmitter is the r-f power output measurement. This one check indicates the proper operation of all the transmitter stages (oscillator, frequency multipliers, driver and final amplifier) with the exception of the modulator and audio circuitry. A properly tuned and operating transmitter will produce at least 1.7 w r-f output into a 50-ohm load with a d-c input of 14.2 volts. It may be necessary to retune the output circuits slightly to match the 50-ohm load. This measurement should be made using a 50-ohm wattmeter connected to one end of the 50-ohm test cable with the other end connected to the external antenna jack.

For further details, refer to the transmitter alignment procedure. If the power output is less than 1.7 w with a d-c input voltage of 14.2 volts, further checking is required. Refer to paragraph 6. TRANSMITTER SERVICE NOTES.

c. Check Overall Receiver Operation

(1) 20 DB Quieting Sensitivity Check

A good overall check of the receiver operation is the 20 db quieting sensitivity measurement. This check will indicate that the receiver has sufficient gain and that all the included circuitry is working properly. The quieting signal is that r-f signal input necessary to reduce the



"Private-Line" Tone-Coded Squelch Models
With Internal Microphone Only
Intercabling Diagram
Motorola No. 63C81033A18-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

"Plug-In" Microphones

Conventional Type
NMN6023B (coiled cord)
NMN6024B (straight cord)

Noise-Cancelling Type
NMN6027B (straight cord)
NMN6028B (coiled cord) EPD-13444-O

C501	8C82396B07	CAPACITOR, fixed: .05 uf ±20%; 50 v (NMN6027B & NMN6028B only)
DP501	59C82960G01	CARTRIDGE: microphone: reluctance type (NMN6023B & NMN6024B)
	or59C83361B01	reluctance type (NMN6027B & NMN6028B)
P501		CONNECTOR, plug: c/o the following items: 1V80755A89 PLUG ASSY: fem. 7 cont. 15C83261C01 SHELL 42B83262C01 CLAMP, cable 3S122924 SCREW, machine: 4-40 x 1/4" Phillips round head; 2 req'd 4S9743 LOCKWASHER: No. 4 split; 2 req'd 2B82681H03 NUT, machine: (retaining ring) 37A868208 SLEEVE, cord, strain relief 3S120421 SET-SCREW: 4-40 x 1/8" Allen hd; cup type 2 req'd
R501	6S129753	RESISTOR, fixed: 100 ±10%; 1/4 w (NMN6027B & NMN6028B only)
S501	40C82863E01	SWITCH, push: spst no; does not incl. 3S129172 SCREW, machine: 3-48 x 3/8" slotted binder hd; 2 req'd
W501	1V80757A98	CORD & PLUG ASSY., microphone: incl. P501 and 30D82565B21 CORD, microphone: coiled type; 4 cond. (NMN6023B & NMN6028B)
	or 1V80755A92	incl. P501 and 30B82285H01 CORD, microphone: straight type; 5 cond.; shielded; 28" length req'd (NMN6024B & NMN6027B)

NON-REFERENCED ITEMS

15C82828E01	HOUSING (front)
1V80748A50	HOUSING (rear) (NMN6023B & NMN6024B)
or 1V80750A12	HOUSING (rear) (NMN6027B & NMN6028B)
41B82856E01	SPRING, backup
38B82833E01	PUSHBUTTON
35A82853E01	DIAPHRAGM, microphone protector (2 req'd for NMN6027B & NMN6028B)
4C82418B22	WASHER, insulating
75A82852E01	PAD, rubber, 1.24" dia.
75A82192A02	PAD, rubber, 0.562" dia.
64A82826E01	PLATE, tapped
7B82801E01	BRACKET, hold-down (NMN6023B & NMN6024B)
or 7B82801E03	BRACKET, hold-down (NMN6027B & NMN6028B)
32A82661C02	GASKET (NMN6023B & NMN6024B)
or32A82661C03	GASKET (NMN6027B & NMN6028B)
42B82831E01	CLAMP, cable
1V80727A18	SPRING & BUSHING ASSY.
1V80727A20	BOARD (eyeleted)

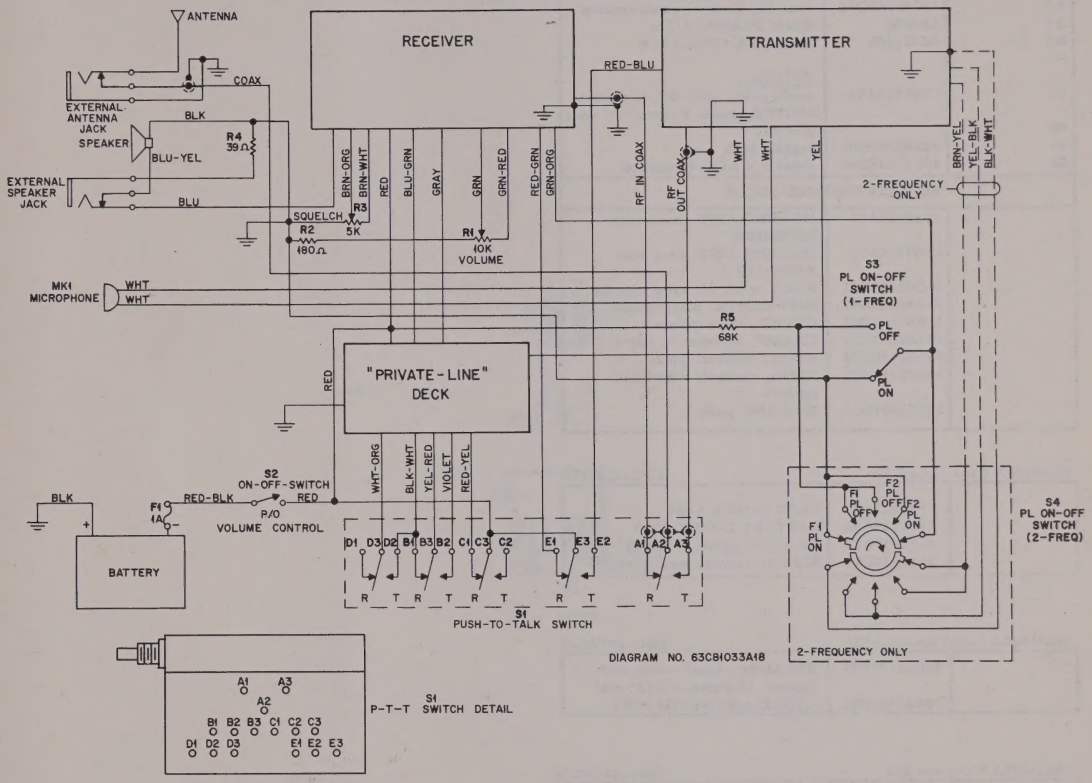
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

SPEAKER-MICROPHONES (external)
NMN6021B (coiled cord)
NMN6022B (straight cord) EPD-13445-O

DP601	50C82162D01	CARTRIDGE, microphone: magnetic type: does not incl. 75A82153D01 PAD, rubber (front) 75B82154D01 PAD, rubber (rear)
LS601	50D82660D01	LOUDSPEAKER, permanent magnet: 2-1/4" weatherproof; 50 ohms imped.
P601		CONNECTOR, plug: c/o the following items: 1V80755A89 PLUG ASSY: fem. 7 cont. 15C83261C01 SHELL 42B83262C01 CLAMP, cable 3S122924 SCREW, machine: 4-40 x 1/4" Phillips round hd; 2 req'd 4S9743 LOCKWASHER: No. 4 split; 2 req'd 2B82681H03 NUT, machine: (retaining ring) 37A868208 SLEEVE, cord strain relief 3S120421 SET-SCREW: 4-40 x 1/8" Allen hd; cup type; 2 req'd
S601	40C82863E01	SWITCH, push; spst no; does not incl. 3S129172 SCREW, machine: 3-48 x 3/8" slotted binder hd; 2 req'd
W601	1V80757A97	CORD & PLUG ASSY.; microphone: incl. P601 and 30D82565B22 CORD, microphone: coiled type; 5 cond. (NMN6021B)
	or 1V80755A91	incl. P601 and 30B83980B01 CORD, microphone: straight type; 5 cond. shld 45" lgth req'd (NMN6022B)

NON-REFERENCED ITEMS

15C82822H01	HOUSING, (front)
1V80738A31	HOUSING, (rear)
3S132731	SCREW, machine: 4-40 x 9/16" Phillips binder head; 4 req'd
4S9743	LOCKWASHER: No. 4 split; 6 req'd
4B82650D06	WASHER: 4 req'd
38B82829H01	PUSHBUTTON
41B82856E01	SPRING, backup
38B82680D01	SPRING, coil
64A82826E01	PLATE, tapped
64A82824H01	PLATE, hold-down
3S135369	SCREW, tapping: No. 0-48 x 3/16" slotted binder hd; 2 req'd
32A82825H01	GASKET: (rubber)
42A82826H01	CLAMP, cable
43A82685D01	SPACER
1V80727A20	BOARD (eyeleted)
35A82258D02	CLOTH, grille



"Private-Line" Tone-Coded Squelch Models
With Internal Microphone Only
Intercabling Diagram
Motorola No. 63C81033A18-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

PARTS LIST for Intercabling Diagram 63C81033A18-A

NHN6070B Housing Kit (1-Freq.)
NHN6071B Housing Kit (2-Freq.) EPD-12531-O

		FUSE, cartridge:
F1	65B82896B02	1 amp/125 v
		JACK, telephone: min;
J1, 2	9C82684D01	does not incl. 15A82688D01 COVER
		SPEAKER, dynamic:
LS1	50D82660D01	coil imped. 50 ohms; 2-1/4" dia; weatherproof
		MICROPHONE, magnetic:
MK1	50C82162D01	imped. 1650 ohms at 1 kc
		RESISTOR,
R1	18C82662D01	var: 10K; 0.12 w; weatherproof incl. spst switch.
R2	6K129662	fixed: 180 ±10%; 1/4 w
R3	18C82661D01	var: 5K; 0.12 w; weatherproof
R4	6R2085	fixed: 39 ±10%; 1/2 w
R5	6K129144	fixed; 68K ±10%; 1/4 w
		SWITCH,
S1	1V80733A91	push: assy; incl. 40C82693D01
S2		SWITCH, push: 5 form "C" cont p/o R40
S3	40B82090H01	toggle: spdt
S4	40C82038G02	rotary: 2 pole; 4 position
	NON-REFERENCED ITEMS	
	1V80724A97	HOUSING ASSY. used with NHN6070B
	1V80724A99	HOUSING ASSY; used with NHN6071B
	36C82659D01	KNOB, control: used with S4
	35A82654D01	DIAPHRAGM, microphone
	15B82651D01	COVER, microphone
	42A82652D01	CLAMP, speaker; 2 req'd.
	36B82766H04	KNOB, control; plain
	36B82766H05	KNOB, control; with BLK pointer
	38B82657D01	BUTTON, push

NLN6236A Rear Cover Kit EPD-12026-O

	1V80723A35	REAR COVER ASSY
	1V80723A36	BATTERY COVER ASSY
	4C82418B09	WASHER, nylon (4 req'd)
	3A82210E01	SCREW; special type (4 req'd)

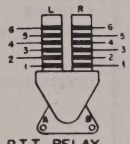
NSN6008A Lapel Speaker Kit EPD-10782-O

	50C82149E01	SPEAKER, lapel: voice coil imped. 15 ohms; 2-1/2" dia.
	30B82580D02	CABLE AND PLUGS ASSY.

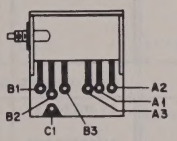
NSN6009A Earpiece Kit EPD-10783-A

	50C82151E01	EARPIECE
	30B82150E01	CABLE AND PLUGS ASSY.

-OFF
CH



P-T-T RELAY



P-T-T SWITCH

7-B

"Private-Line" Tone Coded Squelch
Universal (External/Internal) Models
Intercabling Diagram
Motorola No. 63D81033A17-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

PARTS LIST for Intercabling Diagram 63C81033A18-A

NHN6070B Housing Kit (1-Freq.)
NHN6071B Housing Kit (2-Freq.) EPD-12531-O

		FUSE, cartridge:
F1	65B82896B02	1 amp/125 v
		JACK, telephone: min;
J1, 2	9C82684D01	does not incl. 15A82688D01 COVER
		SPEAKER, dynamic:
LS1	50D82660D01	coil imped. 50 ohms; 2-1/4" dia; weatherproof
		MICROPHONE, magnetic:
MK1	50C82162D01	imped. 1650 ohms at 1 kc
		RESISTOR,
R1	18C82662D01	var: 10K; 0.12 w; weatherproof incl. spst switch.
R2	6K129662	fixed: 180 ±10%; 1/4 w
R3	18C82661D01	var: 5K; 0.12 w; weatherproof
R4	6R2085	fixed: 39 ±10%; 1/2 w
R5	6K129144	fixed; 68K ±10%; 1/4 w
		SWITCH,
S1	1V80733A91	push: assy; incl. 40C82693D01
S2		SWITCH, push: 5 form "C" cont p/o R40
S3	40B82090H01	toggle: spdt
S4	40C82038G02	rotary: 2 pole; 4 position
	NON-REFERENCED ITEMS	
	1V80724A97	HOUSING ASSY. used with NHN6070B
	1V80724A99	HOUSING ASSY; used with NHN6071B
	36C82659D01	KNOB, control: used with S4
	35A82654D01	DIAPHRAGM, microphone
	15B82651D01	COVER, microphone
	42A82652D01	CLAMP, speaker; 2 req'd.
	36B82766H04	KNOB, control; plain
	36B82766H05	KNOB, control; with BLK pointer
	38B82657D01	BUTTON, push

NLN6236A Rear Cover Kit EPD-12026-O

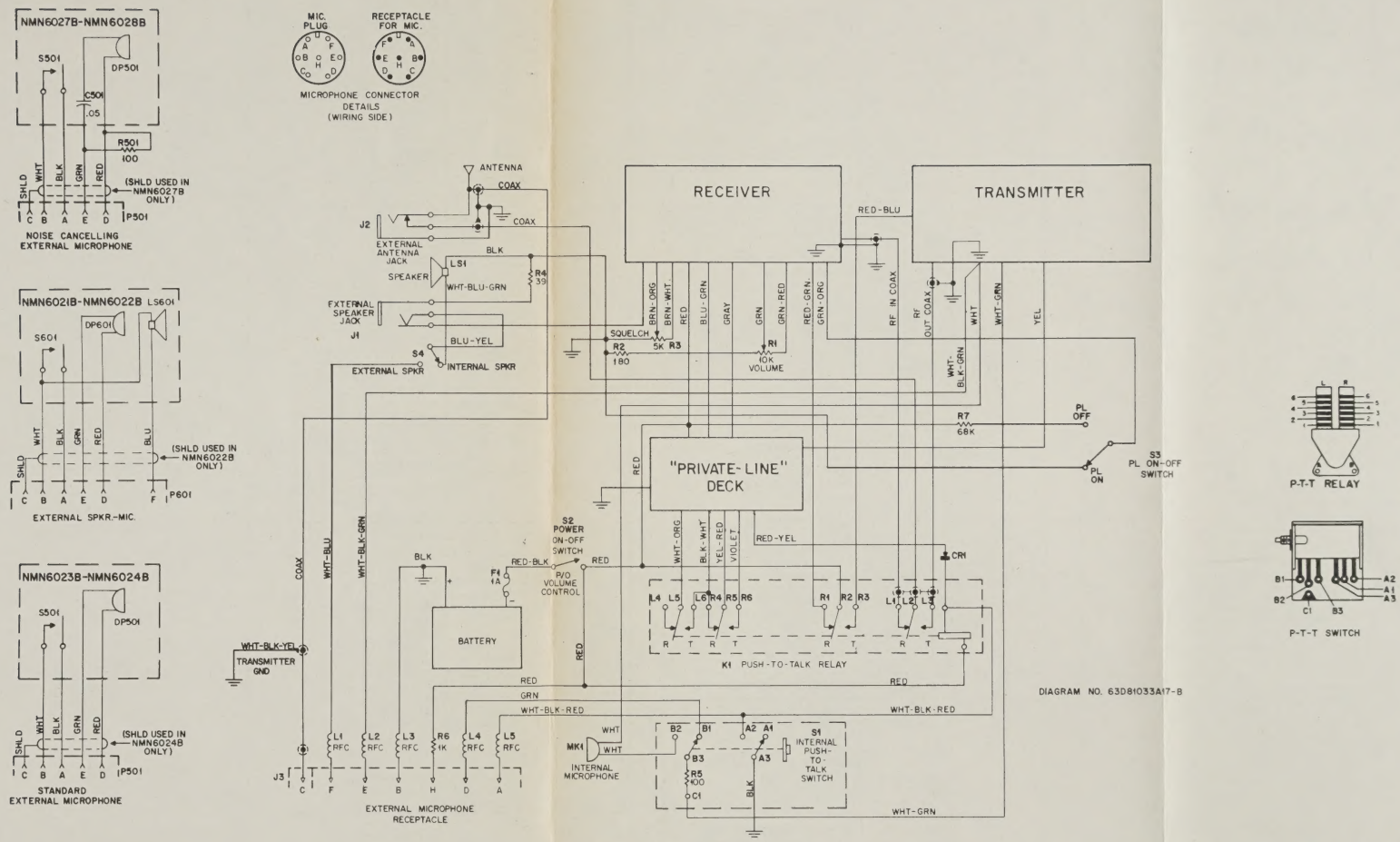
	1V80723A35	REAR COVER ASSY
	1V80723A36	BATTERY COVER ASSY
	4C82418B09	WASHER, nylon (4 req'd)
	3A82210E01	SCREW; special type (4 req'd)

NSN6008A Lapel Speaker Kit EPD-10782-O

	50C82149E01	SPEAKER, lapel: voice coil imped. 15 ohms; 2-1/2" dia.
	30B82580D02	CABLE AND PLUGS ASSY.

NSN6009A Earpiece Kit EPD-10783-A

	50C82151E01	EARPIECE
	30B82150E01	CABLE AND PLUGS ASSY.



"Private-Line" Tone Coded Squelch
Universal (External/Internal) Models
Intercabling Diagram
Motorola No. 63D81033A17-B

E	MOTOROLA PART NO.	DESCRIPTION
		MICROPHONES (external)
		(coiled cord)
		(straight cord) EPD-10779-A
		CARTRIDGE, microphone:
	50C82162D01	magnetic type: does not incl. 75A82153D01 PAD, rubber (front) 75B82154D01 PAD, rubber (rear)
		LOUDSPEAKER, permanent magnet:
	50D82660D01	2-1/4" weatherproof; 50 ohms imped.
		CONNECTOR, plug: consists of the following items: 1V80738A33 PLUG ASSEMBLY: female; 7 contact 15C82683H01 SHELL 42B82682H01 CLAMP, cable 3S122924 SCREW, machine: 4-40 x 1/4" Phillips round head; 2 req'd 4S9743 LOCKWASHER: No. 4 split; 2 req'd 2B82681H01 NUT, machine: (retaining ring) 37B82324G01 SLEEVE, cord strain relief 3S120421 SETSCREW: 4-40 x 1/8" Allen hd; cup type; 2 req'd
		SWITCH, push;
	40C82853E01	spst no; does not incl. 3S129172 SCREW, machine: 3-48 x 3/8" slotted binder hd; 2 req'd
		CORD & PLUG ASSY.: microphone:
	1V80738A32	incl P601 and 30D82565B22 CORD, microphone: coiled type; 5 cond. (NMN6021A)
	or1V80738A34	incl P601 and 30B82285H01 CORD, microphone: straight type: 5 cond. shld 45" lgth reqd (NMN6022A)
		NON-REFERENCED ITEMS
	15C82822H01	HOUSING, (front)
	1V80738A31	HOUSING, (rear)
	3S132731	SCREW, machine: 4-40 x 9/16" Phillips binder head; 4 req'd
	4S9743	LOCKWASHER: No. 4 split; 6 req'd
	4B82650D06	WASHER: 4 req'd
	38B82829H01	PUSHBUTTON
	41B82856E01	SPRING, backup
	38B82680D01	SPRING, coil
	64A82826E01	PLATE, tapped
	64A82824H01	PLATE, hold-down
	3S132523	SCREW, tapping: No. 0 x 5/32" slotted binder hd; 2 req'd
	32A82825H01	GASKET: (rubber)
	42A82826H01	CLAMP, cable
	43A82685D01	SPACER
	1V80727A20	BOARD (eyeleted)
	35A82258D02	CLOTH, grille

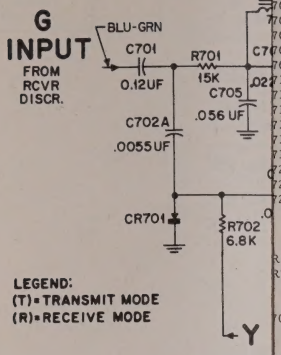
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		NLN6331A Rear Cover Kit EPD-10781-O
	1V80733A54	REAR COVER ASSY.
	1V80723A36	BATTERY COVER ASSY.
	4C82418B09	WASHER, nylon: 4 req'd
	3A82210E01	SCREW: special type; 4 req'd
		NSN6008A Lapel Speaker Kit EPD-10782-O
	50C82149E01	SPEAKER, lapel: voice coil imped. 15 ohms; 2-1/2" dia.
	30B82580D02	CABLE AND PLUGS ASSY.
		NSN6009A Earpiece Kit EPD-10783-A
	50C82151E01	EARPIECE
	30B82150E01	CABLE AND PLUGS ASSY.

NOTE:

Replacement transistors and diodes must be ordered by Motorola part number only for optimum performance.

PARTS LIST for Schematic Diagram 63D81036A16-A

LD6210A "Private-Line" Squelch Deck EPD-12688-O



REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uf; ±10%; unl stated
701	23D82397D20	0.12 ±20%; 35 v; non-polarized
702	21C82724H01	dual sect; c/o:
702A		.0055 +100-20%; 75 v
702B		.0055 +100-20%; 75 v
704	23D82397D13	.022; 6 v
705	23D82397D10	.056; 35 v
707, 719	23D82397D14	.082; 20 v
708, 722	21K861441	500 uuf ±10%; 75 v; N4700
709	23D82397D05	4.7 +40-20%; 3 v
710, 728	21K847065	500 uuf; GMV; 250 v
711, 713, 729	23D82397D07	1 +40-20%; 15 v
712, 714	23D82397D23	6.8 ±20%; 20 v
715, 717	23D82397D09	6.8 +40-20%; 10 v
716, 721	23D82397D16	22 ±20%; 15 v
718	23D82397D28	3.3 20 v
720	23D82397D25	0.27; 20 v
723	21K861442	.002 +100-20%; 75 v
727	21K831126	.002 GMV; 300 v
		SEMICONDUCTOR DEVICE, diode: NOTE
R701	48C82392B03	silicon
R702	48C82178A01	germanium
		REACTOR: AF choke:
702	25C82750D02	7 h
		COIL, RF: choke:
703	24D82723H01	1.2 uh
		TRANSISTOR: NOTE
701, 702, 703	48R869033	P-N-P; type M9033
		RESISTOR, fixed: ±10%; 1/8 w; unl stated
701, 708	6S185B93	15K
702	6K128687	6.8K; 1/4 w
703, 713	6S185B90	8.2K
704, 705, 714, 6, 726	6S185C01	56K
706	6S185B70	180
709	6S185C05	120K
710	6S127803	10K; 1/4 w
711	18C82876B01	var; 4K ±20%; 1/20 w
715, 717	6S185B83	2.2K
718	6S129752	270; 1/4 w
719	6K129225	10K; 1/4 w
720	6S129269	1.8K 1/4 w
721	6S185B76	560
727	6K127801	470; 1/4 w
	NON-REFERENCED ITEM	
	1V80724A84	PRINTED CIRCUIT BD. ASSY.

REVISIONS

DIAG. ISSUE	BOARD AND SUFFIX NO.	REF. SYMBOL	CH
A	NLD6210A-7		WAS RED CONNECT ANODE O

N6017A Handset (Plug-in, Carbon)

-1	50D82433G01	HANDSET, carbon incl P1, W1 and the following items 55P82446G01; HANDLE (only) 15P82446G02; CAP; transmitter 15P82446G03; CAP; receiver 40P82446G04; SWITCH 59P82446G05; CARTRIDGE; receiver 59P82446G06; CARTRIDGE; transmitter 4K84985; WASHER; strain relief 37A842245; SLEEVE, strain relief
	30D82565B19	CORD, microphone 4 cond; each cond no. 23 ga. str. incl plug (P1); NOTE: connector P1 not replaceable

MODEL TABLE

Model No.	Chassis Su
NLD6210A	7

NOTES:

1. UNLESS OTHERWISE STATED:
   RESISTOR VALUES ARE IN OHMS; K =
   CAPACITOR VALUES ARE IN MICROM
2. CONTACTS IN PARENTHESIS ARE THOS
   IN EXTERNAL MICROPHONE MODELS.
3. REFER TO B- NETWORK ON TRANSMIT
   SCHEMATIC DIAGRAMS.
4. REFER TO INTERCABLING DIAGRAM FO
   CODED SQUELCH, EXTERNAL MICROPH
5. REFER TO B- NETWORK ON "PRIVATE-
   DIAGRAM.
6. POINT "A" IS CONNECTED AS FOLLOWS
   TONE-CODED SQUELCH MODELS INTER
   A. ON INTERNAL MICROPHONE (ONLY
      CONNECTED TO CONTACT C1 ON T
   B. ON INTERNAL/EXTERNAL MICROP
      IS CONNECTED TO THE ANODE OF
      THE P-T-T RELAY).
7. REFER TO "IDC" ADJUSTMENT PROCE
   OF THIS CONTROL.

TES:

I Replacement transistors and diodes must be ordered by Motorola part number only for optimum performance.

II Crystals are part of the Radio Set Model only. When ordering crystal units specify car. freq.(s), crystal freq.(s) and crystal type number.

"Private-Line" Squelch Deck
Schematic Diagram and Printed
Circuit Board Detail
Motorola No. EPD-12668-A

PARTS LIST for Intercabling Diagram 63D81033A17-B

NHN6104B Housing Kit (1-Freq. Xmtr. & 1-Freq. Rcvr.)
NHN6080B Housing Kit (1-Freq. Xmtr. & 1-Freq. Rcvr. with rigid antenna) EPD-12525-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		SEMICONDUCTOR DEVICE, diode: (NOTE)
CR1	48C82392B03	silicon
		FUSE, cartridge:
F1	65B82896B02	1 amp/125 v
		JACK, receptacle:
J1, 2	9C82684D01	does not incl. 15A82688D01 COVER, jack
J3	1V80738A13	male; 7 cont.
		RELAY, armature:
K1	80C82675H02	4 form "C"; coil res. 150 ohms
		COIL, RF; choke:
L1, 2, 3, 4, 5	24C82723H01	1.2 uh
		SPEAKER, dynamic:
LS1	50D82660D01	coil imped. 50 ohms; 2-1/4" dia; weatherproof
		MICROPHONE, magnetic:
MK1	50C82162D01	imped. 1650 ohms at 1 kc
		RESISTOR, variable:
R1	18C82662D01	10K; 0.12 w weatherproof; incl. spst switch
R2	6K129662	fixed: 180 ±10%; 1/4 w
R3	18C82661D01	5K; 0.12 w; weatherproof
R4	6R2085	fixed; 39 ±10%; 1/2 w
R5	6R129753	100 ±10%; 1/4 w
R6	6R127802	1K ±10%; 1/4 w
R7	6K129144	68K ±10%; 1/4 w
		SWITCH,
S1	1V80733A90	push; assy; incl. 40C82957G01 SWITCH, push: 2 form "C" contacts; (spring return)
S2		p/o R40
S3	40B82090H01	toggle; spdt
S4	40C82009H01	slide; contacts, 1 form "Z"; used as spdt; does not incl. 11M32626 TUBING, heat shrink No. 18 clear (specify length req'd.)
	NON-REFERENCED ITEMS	
	1V80738A75	HOUSING ASSY. part of NHN6104B
	1V80725A02	HOUSING ASSY. part of NHN6080B
	35A82654D01	DIAPHRAGM, microphone
	15B82651D01	COVER, microphone
	42A82652D01	CLAMP, speaker: 2 req'd.
	36B82766H04	KNOB, control: plain
	36B82766H05	KNOB, control: with BLK pointer
	38B82657D01	BUTTON, push

"Plug-In" Microphones

Conventional Type
NMN6023A (coiled cord)
NMN6024A (straight cord)

Noise-Cancelling Type
NMN6027A (straight cord)
NMN6028A (coiled cord) EPD-11677-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C501	8C82396B07	CAPACITOR, fixed: .05 uf ±20%; 50 v (NMN6027A & NMN6028A only)
DP501	59C82960G01	CARTRIDGE: microphone: reluctance type (NMN6023A & NMN6024A)
	or59C83361B01	reluctance type (NMN6027A & NMN6028A)
P501		CONNECTOR, plug: c/o the following items: 1V80738A33 PLUG ASSY: fem. 7 cont 15C82683H01 SHELL 42B82682H01 CLAMP, cable 3S122924 SCREW, machine: 4-40 x 1/4" Phillips round head; 2 req'd 4S9743 LOCKWASHER: No. 4 split; 2 req'd 2B82681H01 NUT, machine: (retaining ring) 37B82324G01 SLEEVE, cord, strain relief 3S120421 SETSCREW; 4-40 x 1/8" Allen hd; cup type 2 req'd
R501	6S129753	RESISTOR, fixed: 100 ±10%; 1/4 w (NMN6027A & NMN6028A only)
S501	40C82863E01	SWITCH, push: spst no; does not incl 3S129172 SCREW, machine: 3-48 x 3/8" slotted binder hd; 2 req'd
W501	1V80738A36	CORD & PLUG ASSY., microphone: incl P501 and 30D82565B21 CORD, microphone: coiled type; 4 conductor (NMN6023A & NMN6028A)
	or1V80738A37	incl P501 and 30B82285H01 CORD, microphone: straight type; 5 conductor; shielded; 28" length req'd (NMN6024A & NMN6027A)
	NON-REFERENCED ITEMS	
	15C82829E01	HOUSING (front)
	1V80748A50	HOUSING (rear) (NMN6023A & NMN6024A)
	or1V80750A12	HOUSING (rear) (NMN6027A & NMN6028A)
	41B82856E01	SPRING, backup
	38B82833E01	PUSHBUTTON
	35A82853E01	DIAPHRAGM, microphone protector
	4C82418B22	WASHER, insulating
	75A82852E01	PAD, rubber, 1.24" dia.
	75A82192A02	PAD, rubber: 0.562" dia.
	64A82826E01	PLATE, tapped
	7B82801E01	BRACKET, hold-down (NMN6023A & NMN6024A)
	or 7B82801E03	BRACKET, hold-down (NMN6027A & NMN6028A)
	32A82661C02	GASKET (NMN6023A & NMN6024A)
	or32A82661C03	GASKET (NMN6027A & NMN6028A)
	42B82831E01	CLAMP, cable
	1V80727A18	SPRING & BUSHING ASSY.
	1V80727A20	BOARD (eyeleted)

SPEAKER-MICROPHONES (external)
NMN6021A (coiled cord)
NMN6022A (straight cord) EPD-10779-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
DP601	50C82162D01	CARTRIDGE, microphone: magnetic type: does not incl. 75A82153D01 PAD, rubber (front) 75B82154D01 PAD, rubber (rear)
LS601	50D82660D01	LOUDSPEAKER, permanent magnet: 2-1/4" weatherproof; 50 ohms imped.
P601		CONNECTOR, plug: consists of the following items: 1V80738A33 PLUG ASSEMBLY: female; 7 contact 15C82683H01 SHELL 42B82682H01 CLAMP, cable 3S122924 SCREW, machine: 4-40 x 1/4" Phillips round head; 2 req'd 4S9743 LOCKWASHER: No. 4 split; 2 req'd 2B82681H01 NUT, machine: (retaining ring) 37B82324G01 SLEEVE, cord strain relief 3S120421 SETSCREW: 4-40 x 1/8" Allen hd; cup type; 2 req'd
S601	40C82853E01	SWITCH, push: spst no; does not incl. 3S129172 SCREW, machine: 3-48 x 3/8" slotted binder hd; 2 req'd
W601	1V80738A32	CORD & PLUG ASSY.; microphone: incl P601 and 30D82565B22 CORD, microphone: coiled type; 5 cond.(NMN6021A)
	or1V80738A34	incl P601 and 30B82285H01 CORD, microphone: straight type: 5 cond, shld 45" lgth reqd (NMN6022A)
	NON-REFERENCED ITEMS	
	15C82822H01	HOUSING, (front)
	1V80738A31	HOUSING, (rear)
	3S132731	SCREW, machine: 4-40 x 9/16" Phillips binder head; 4 req'd
	4S9743	LOCKWASHER: No. 4 split; 6 req'd
	4B82650D06	WASHER: 4 req'd
	38B82829H01	PUSHBUTTON
	41B82856E01	SPRING, backup
	38B82680D01	SPRING, coil
	64A82826E01	PLATE, tapped
	64A82824H01	PLATE, hold-down
	3S132523	SCREW, tapping: No. O x 5/32" slotted binder hd; 2 req'd
	32A82825H01	GASKET: (rubber)
	42A82826H01	CLAMP, cable
	43A82685D01	SPACER
	1V80727A20	BOARD (eyeleted)
	35A82258D02	CLOTH, grille

NLN6331A Rear Cover Kit EPD-10781-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	1V80733A54	REAR COVER ASSY.
	1V80723A36	BATTERY COVER ASSY.
	4C82418B09	WASHER, nylon: 4 req'd
	3A82210E01	SCREW: special type; 4 req'd

NSN6008A Lapel Speaker Kit EPD-10782-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	50C82149E01	SPEAKER, lapel: voice coil imped. 15 ohms; 2-1/2" dia.
	30B82580D02	CABLE AND PLUGS ASSY.

NSN6009A Earpiece Kit EPD-10783-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	50C82151E01	EARPIECE
	30B82150E01	CABLE AND PLUGS ASSY.

NOTE:

Replacement transistors and diodes must be ordered by Motorola part number only for optimum performance.

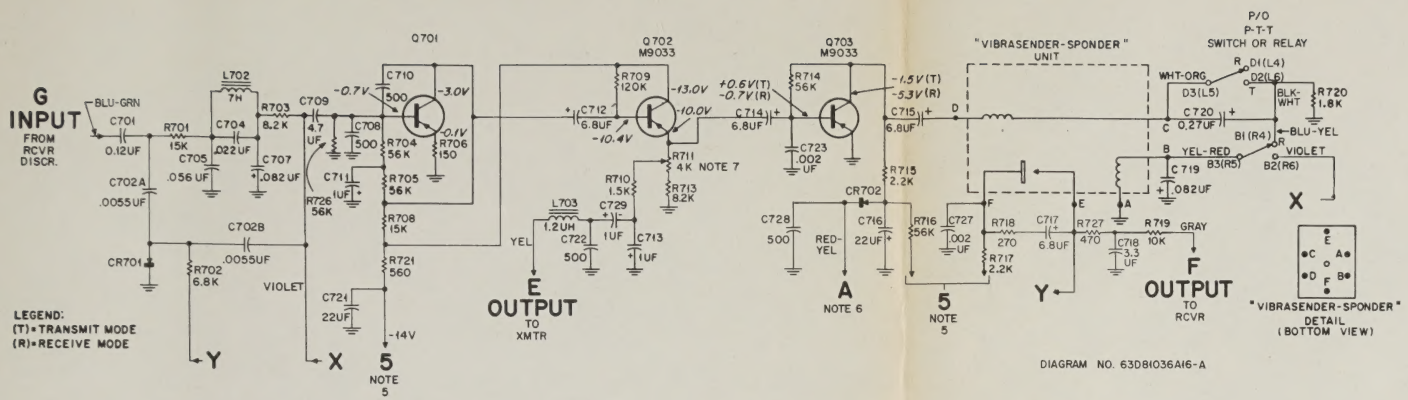
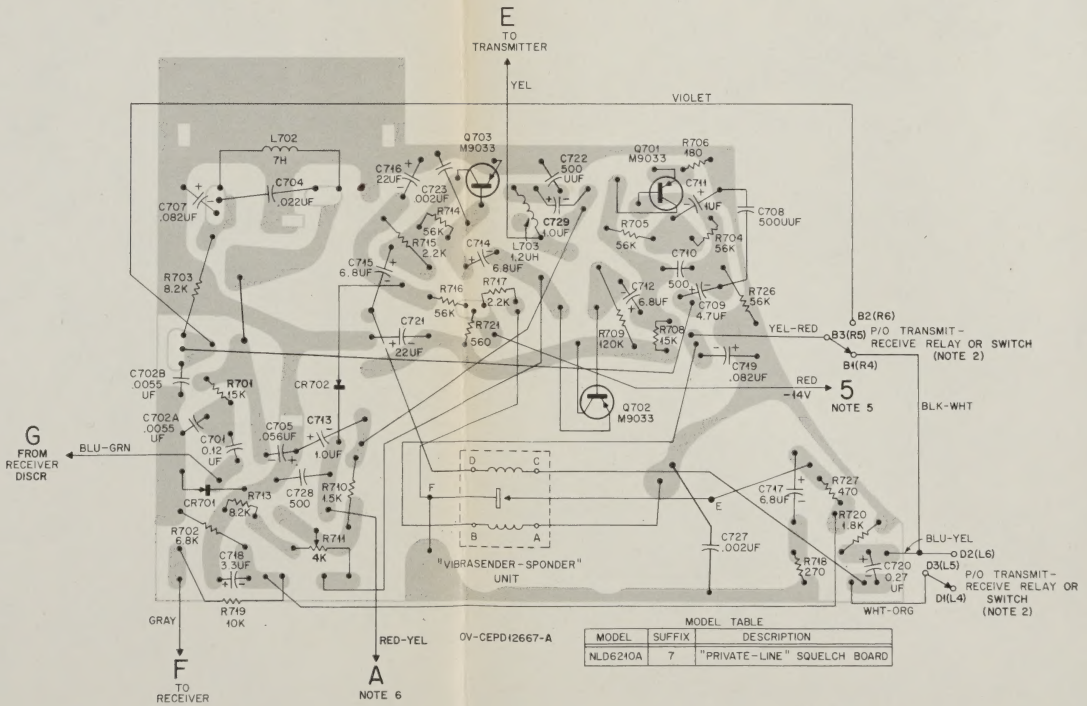


DIAGRAM NO. 63D81036A16-A

REVISIONS

DIAG. ISSUE	BOARD AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
A	NLD6210A-7		WAS RED-YEL LEAD CONNECTED TO ANODE OF CR702	Q702 COLLECTOR



MODEL TABLE

MODEL	SUFFIX	DESCRIPTION
NLD6210A	7	"PRIVATE-LINE" SQUELCH BOARD

MODEL TABLE

Model No.	Chassis Suffix
NLD6210A	7

NOTES:

1. UNLESS OTHERWISE STATED:
   RESISTOR VALUES ARE IN OHMS; K = 1000.
   CAPACITOR VALUES ARE IN MICROMICROFARADS.
2. CONTACTS IN PARENTHESIS ARE THOSE ON THE P-T-T RELAY IN EXTERNAL MICROPHONE MODELS.
3. REFER TO B- NETWORK ON TRANSMITTER AND RECEIVER SCHEMATIC DIAGRAMS.
4. REFER TO INTERCABLING DIAGRAM FOR "PRIVATE-LINE" TONE-CODED SQUELCH, EXTERNAL MICROPHONE MODELS.
5. REFER TO B- NETWORK ON "PRIVATE-LINE" RECEIVER SCHEMATIC DIAGRAM.
6. POINT "A" IS CONNECTED AS FOLLOWS: REFER TO "PRIVATE-LINE" TONE-CODED SQUELCH MODELS INTERCABLING DIAGRAMS.
   A. ON INTERNAL MICROPHONE (ONLY) MODELS, THIS POINT IS CONNECTED TO CONTACT C1 ON THE P-T-T SWITCH.
   B. ON INTERNAL/EXTERNAL MICROPHONE MODELS, POINT A IS CONNECTED TO THE ANODE OF CR1 (IN COIL LEAD OF K1, THE P-T-T RELAY).
7. REFER TO "IDC" ADJUSTMENT PROCEDURE FOR PROPER SETTING OF THIS CONTROL.

EPD-12517-O

PARTS LIST for Schematic Diagram 63D81036A16-A

NLD6210A "Private-Line" Squelch Deck EPD-12688-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uf; ±10%; unl stated
C701	23D82397D20	0.12 ±20%; 35 v; non-polarized
C702	21C82724H01	dual sect; c/o:
C702A		.0055 +100-20%; 75 v
C702B		.0055 +100-20%; 75 v
C704	23D82397D13	.022; 6 v
C705	23D82397D10	.056; 35 v
C707, 719	23D82397D14	.082; 20 v
C708, 722	21K861441	500 uuf ±10%; 75 v; N4700
C709	23D82397D05	4.7 +40-20%; 3 v
C710, 728	21K847065	500 uuf; GMV; 250 v
C711, 713, 729	23D82397D07	1 +40-20%; 15 v
C712, 714	23D82397D23	6.8 ±20%; 20 v
C715, 717	23D82397D09	6.8 +40-20%; 10 v
C716, 721	23D82397D16	22 ±20%; 15 v
C718	23D82397D28	3.3 20 v
C720	23D82397D25	0.27; 20 v
C723	21K861442	.002 +100-20%; 75 v
C727	21K831126	.002 GMV; 300 v
		SEMICONDUCTOR DEVICE, diode: NOTE
CR701	48C82392B03	silicon
CR702	48C82178A01	germanium
		REACTOR: AF choke:
L702	25C82750D02	7 h
		COIL, RF: choke:
L703	24D82723H01	1.2 uh
		TRANSISTOR: NOTE
Q701, 702, 703	48R869033	P-N-P; type M9033
		RESISTOR, fixed: ±10%; 1/8 w; unl stated
R701, 708	6S185B93	15K
R702	6K128687	6.8K; 1/4 w
R703, 713	6S185B90	8.2K
R704, 705, 714, 716, 726	6S185C01	56K
R706	6S185B70	180
R709	6S185C05	120K
R710	6S127803	10K; 1/4 w
R711	18C82876B01	var; 4K ±20%; 1/20 w
R715, 717	6S185B83	2.2K
R718	6S129752	270; 1/4 w
R719	6K129225	10K; 1/4 w
R720	6S129269	1.8K 1/4 w
R721	6S185B76	560
R727	6K127801	470; 1/4 w
	NON-REFERENCED ITEM	
	1V80724A84	PRINTED CIRCUIT BD. ASSY.

NMN6017A Handset (Plug-in, Carbon)

HS-1	50D82433G01	HANDSET, carbon incl P1, W1 and the following items 55P82446G01; HANDLE (only) 15P82446G02; CAP; transmitter 15P82446G03; CAP; receiver 40P82446G04; SWITCH 59P82446G05; CARTRIDGE; receiver 59P82446G06; CARTRIDGE; transmitter 4K84985; WASHER; strain relief 37A842245; SLEEVE, strain relief
W1	30D82565B19	CORD, microphone 4 cond; each cond no. 23 ga. str. incl plug (P1); NOTE: connector P1 not replaceable

NOTES:

I Replacement transistors and diodes must be ordered by Motorola part number only for optimum performance.

II Crystals are part of the Radio Set Model only. When ordering crystal units specify car. freq.(s), crystal freq.(s) and crystal type number.

"Private-Line" Squelch Deck
Schematic Diagram and Printed Circuit Board Detail
Motorola No. EPD-12668-A

REV

HASSIS AND SUFFIX NO.	REF. SYMBOL	C
RD1131BA-5 RD1132BA-4	C90, 91	ADDE
	C81	WAS 2
RD1131BA-6 RD1132BA-5 RD1131BB-5 RD1132BB-4	R37	WAS 6

DESCRIPTION
6A82686D01 SLEEVE, iron ong)
F: VIO-VIO; does not incl
6K847160 CORE, tuning nor 6A82686D01 SLEEVE, iron ong)
F: coded GRN; incl: pri: 1K ax; sec: res 200 max.
RYSTAL UNIT quartz: OTE II eceiver control 1.245 mc
ED ITEM
HIELD, coil: 14 req'd

(60 KC) EPD-10772-A

ESISTOR, fixed: 5K ±10%; 1/10 w
APACITOR, fixed: uuf; 5 ±10%; 75 v; N150 20 ±10%; 75 v; N1400 00 GMV; 250 v

EPD-12003-O

ILTER, IF: ndpass; 30 kc ndpass; 60 kc

82-150.8 mc)
50.8-174 mc) EPD-10774-O

APACITOR , fixed: 75 v; uuf ±5%; N150 uuf ±10%; N150 4 uuf ±10%; N150 002 uf +100-20%
EMICONDUCTOR DEVICE, iode: NOTE I ilicon
OIL, RF: IO-BLK; does not incl 6B82451B02 CORE, tuning IO-YEL; does not incl 6B82451B02 CORE, tuning
RANSISTOR: NOTE I -N-P; type M9168
ESISTOR, fixed: ±10%; 1/4 w; K 80
RYSTAL UNIT, quartz: OTE II

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

NOTES:

I. Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

II. Crystals are part of the complete radio set model (not part of the receiver model). When ordering crystal units, specify carrier frequency, crystal frequency and crystal part (type) number.

REVISIONS

DIAG. ISSUE	CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION	REFER TO CIRCUIT BOARD
A	NRD1131BA-5 NRD1132BA-4	C90, 91	ADDED	Q8 & Q10 COLLECTOR CKT	EPD-11929-O
		C81	WAS 21K865197	Q9 COLLECTOR CIRCUIT	
B	NRD1131BA-6 NRD1132BA-5 NRD1131BB-5 NRD1132BB-4	R37	WAS 6K127806	DISCRIMINATOR CIRCUIT, CR6 ANODE	EPD-10461-F

PARTS LIST for Schematic Diagram 63E81032A31-B

LEGEND
L = 132-150.8 MC
H = 150.8-174 MC

NRD6111BA Receiver Circuit Board (132-150.8 MC) 1-Freq.
NRD6112BA Receiver Circuit Board (150.8-174 MC) 1-Freq.

EPD-10771-C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uuf; ±10% 75 v; unl stated
C1L	21K861462	15; N150
C1H, 4L, 19L, 9L	21K861431	12; N150
C2L	21K861434	40; N150
C2H, 5L	21D82877B06	30; N150
C3, 29	21C82450B22	0.75; 500 v
C4H, 9H, 19H	21K867807	8 ±5%; N080
C5H, 16	21D82877B01	24; N150
C6, 12, 18, 83	21K861437	100; N2200
C7, 8	21C82450B26	0.3; 500 v
C10L, 11L	21K861430	10; N150
C10H, 11H	21D82877B13	7; ±5%; N150
C14, 36, 38, 75	21K861442	.002 uf +100-20%
C15L, 25	21D82877B17	5 ±5%; N150
C15H	21K861427	4; N150
C17L, 88H	21K861603	3.3; NP0
C17H	21D82450B28	1
C20L, 40	21K865197	25; NP0
C20H	21K861432	20; N150
C21	21K864522	90; N080
C22, 39, 59	21D82877B02	150; N1400
C23, 24	21C831126	.002 uf GMV; 300 v
C26, 34, 89	21K864521	30; N750
C27	21K861436	100; N750
C28, 37, 42, 44, 45, 46, 48, 49, 51, 56, 61, 86	21K861443	.01 uf +100-20%
C30	21C82450B24	0.47; 500 v
C31	21D82450B24	0.47; 500 v
C32, 33	21K864067	80; N150
C35, 50	21K861444	.02 uf +100-20%
C41	21K861429	8; N150
C43, 47, 54	21K847065	500 GMV; 250 v
C52	21D82239E02	800 ±5%; 200 v
C53	23C82397D06	0.22 uf +40-20%; 35 v
C55, 70	23C82397D16	22 uf ±20%; 15 v
C57	21K864457	.002 uf +100-20%
C58, 62	8C82317B03	.03 uf; 50 v
C60	21K859943	250 ±5%; 500 v
C63, 79	23D82397D19	2 uf +40-20%; 8 v
C64	23C82397D05	4.7 uf +40-20%; 3 v
C65	23D82397D32	2 uf +40-20%; 8 v
C66, 67, 71	23C82397D17	15 uf ±20%; 20 v
C68	21C82187B16	3000; 100 v
C69	23C82397D07	1 uf +40-20%; 15 v
C72	23C82397D31	10 uf ±20%; 20 v
C73	23C82397D15	10 uf ±20%; 20 v
C74	23C82397D08	0.15 uf +40-20%; 35 v
C82	21K868829	220
C88L	21D82877B07	2.2; N150
		SEMICONDUCTOR DEVICE, diode: NOTE I
CR1	48C82363E03	silicon
CR2	48C859464	germanium
CR3	48C82363E01	silicon
CR4, 6, 7	48C82178A01	germanium
CR8, 9, 10	48C82392B03	silicon
L1L	24V80903A02	COIL ASSEMBLY, RF: incl C1L, C3 and 24C82710H01 COIL, RF: VIO-BRN; does not incl 76B82451B04 CORE, tuning
L1H	24V80903A01	incl C1H, C3 and 24C82710H01 COIL, RF: VIO-BRN: does not incl 76B82451B04 CORE, tuning
L3L	24V80903A04	incl C7, C9L, and 24C82711H09 COIL, RF: ORG-ORG; does not incl 76B82451B04 CORE, tuning
L3H	24V80903A03	incl C7, C9H and 24C82711H01 COIL, RF: VIO-RED; does not incl 76B82451B04 CORE, tuning
L5L	24V80903A06	incl C8, C11L, CR2 and 24C82711H03 COIL RF: VIO-ORG; does not incl 76B82451B04 CORE tuning
L5H	24V80903A05	incl C8, C11H, CR2 and 24C82711H03 COIL, RF: VIO-ORG; does not incl 76B82451B04 CORE, tuning
L14L	24V80903A08	incl C17L, C83L, CR3 and 24C82710H02 COIL, RF: VIO-GRN: does not incl 76B82451B04 CORE, tuning
L14H	24V80903A07	incl C17H, C83H, CR3 and 24C82710H02 COIL, RF: VIO-GRN; does not incl 76B82451B04 CORE, tuning
L15L	24V80903A10	incl C19L and 24C82710H02 COIL, RF: VIO-GRN; does not incl 76B82451B04 CORE, tuning
L15H	24V80903A09	incl C19H and 24C82710H02 COIL, RF: VIO-GRN; does not incl 76B82451B04 CORE, tuning
		COIL, RF: adjustable;
L2, 4	24C82710H01	VIO-BRN; does not incl 76B82451B04 CORE, tuning
L6	24C82711H02	VIO-BLU; does not incl 76K847160 CORE, tuning nor 76A82686D01 SLEEVE, iron (long)
L7, 8	24C82710H03	VIO-GRAY; does not incl 76K847160 CORE, tuning, nor 76A82686D01 SLEEVE, iron (long)
L9	24C82695D01	pri: 1, 2 w/center tap (5) sec: 3, 4 (tuning core incl)
L10	24C82696D01	bifilar winding (incl tuning core)
L13L	24C82711H05	VIO-BLK; does not incl 76B82451B02 CORE, tuning, nor 76A82686D01 SLEEVE, iron (long)
L13H	24C82711H04	VIO-YEL; does not incl 76B82451B02 CORE, tuning, nor 76A82686D01 SLEEVE, iron (long)
		REACTOR:
L12	25B82751D01	AF choke; 1.5 h
		TRANSISTOR: NOTE I
Q1	48R869223	P-N-P; type M9223
Q2, 5	48R869168	P-N-P; type M9168
Q3	48R869238	P-N-P; type M9238
Q4	48R869062	N-P-N; type M9062
Q6, 7, 8, 9, 10, 11	48R869057	P-N-P; type M9057
Q12, 13	48R869148	P-N-P; type M9148
Q14	48R869022	N-P-N; type M9022
Q15	48R869028	P-N-P; type M9028
Q16	48R869027	N-P-N; type M9027
		RESISTOR, fixed: ±10%; 1/4 w unl stated
R1, 43	6K128904	18K
R2, 22, 24, 26, 28, 30, 45, 47	6K127804	4.7K
R3, 4	6K128432	820
R5, 21, 23, 25, 27, 29	6K1Z7807	33K
R6, 16	6K128687	6.8K
R7	6K128599	680
R8, 34, 69	6K127802	1K
R9	6S129230	12K
R10	6K129863	390
R11, 38, 54, 55	6K127806	27K
R12, 65	6K129433	5.6K
R13	6K129818	820 ±5%
R14, 52, 57	6K127801	470
R15	6K128902	47K
R18, 59	6K129775	330
R19	6K129225	10K
R20, 32, 39, 44	6K128688	2.7K
R31	6K128685	22K
R33, 50	6K128689	2.2K
R37	6S185B96	27K; 1/8 w
R46	6K129144	68K
R49	6R129984	680 ±5%
R51	6K129233	47
R53	6K127804	4.7K
R58	6K129862	150
R60	6K128686	8.2K
R62	6K129269	1.8K
		TRANSFORMER,
T1	24C82712H02	RF: VIO-WHT; does not incl 76K847160 CORE, tuning nor
T2	24C82712H01	76A82686D01 SLEEVE, iron (long) RF: VIO-VIO; does not incl 76K847160 CORE, tuning nor 76A82686D01 SLEEVE, iron (long)
T3	1V80729A40	AF: coded GRN; incl: pri: 1K max; sec: res 200 max.
		CRYSTAL UNIT, quartz: NOTE II
Y1	YMW-35	receiver control
Y2	YNW	11.245 mc
NON-REFERENCED ITEM		
	26B82671D01	SHIELD, coil: 14 req'd

NLN6234A Resistor-Capacitor Kit (60 KC) EPD-10772-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
R35, 36	6K128563	RESISTOR, fixed: 15K ±10%; 1/10 w
		CAPACITOR, fixed: uuf;
C81, 90, 91	21K865197	25 ±10%; 75 v; N150
C82	21K868829	220 ±10%; 75 v; N1400
C83	21K847065	500 GMV; 250 v

FILTER EPD-12003-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
Z1	NFN6006AS NFN6006AW	FILTER, IF: bandpass; 30 kc bandpass; 60 kc

NLD6221A 2nd Freq. Oscillator (132-150.8 mc)
NLD6222A 2nd Freq. Oscillator (150.8-174 mc) EPD-10774-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: 75 v;
C301L	21D82877B17	5 uuf ±5%; N150
C301H	21K861427	4 uuf ±10%; N150
C302	21D82877B01	24 uuf ±10%; N150
C303	21K861442	.002 uf +100-20%
		SEMICONDUCTOR DEVICE, diode: NOTE I
CR301	48C82363E01	silicon
		COIL, RF:
L301L	24C82766D08	VIO-BLK; does not incl 76B82451B02 CORE, tuning
L301H	24C82766D05	VIO-YEL; does not incl 76B82451B02 CORE, tuning
		TRANSISTOR: NOTE I
Q301	48R869168	P-N-P; type M9168
		RESISTOR, fixed: ±10%; 1/4 w;
R301	6K127802	1K
R302	6K128599	680
		CRYSTAL UNIT, quartz: NOTE II
Y301	YMW-35	

NOTES:

I. Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

II. Crystals are part of the complete radio set model (not part of the receiver model). When ordering crystal units, specify carrier frequency, crystal frequency and crystal part (type) number.

FINAL AUDIO AMPLIFIER

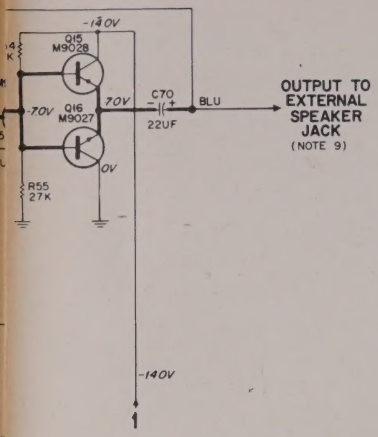


DIAGRAM NO. 63E81032A31

ES:

UNLESS OTHERWISE STATED:
RESISTOR VALUES ARE IN OHMS, ±10%, 1/4W, K=1000.
ALL CAPACITOR VALUES ARE IN MICROMICROFARADS.

REFER TO PARTS LIST FOR COMPONENT VALUE.

USED IN SINGLE FREQUENCY MODELS ONLY.

FREQUENCY CALCULATIONS:
RECEIVER: $f_o = \frac{f_c - 11.7\,MC}{3}$
SEE 2ND OSCILLATOR FREQUENCY TABLE.

ALL VOLTAGE READINGS REFERENCED TO CHASSIS GROUND.
DC READINGS TAKEN WITH A MOTOROLA DC MULTIMETER.

PART OF HOUSING KIT

FOR UNITS IN 132-142 AND 150.8-162 MC RANGE JUMPER TO "LO" CONNECTION
FOR UNITS IN 142-150.8 AND 162-174 MC RANGE JUMPER TO "HI" CONNECTION

REFER TO TRANSMITTER SCHEMATIC DIAGRAM.

REFER TO INTERCABLING DIAGRAMS.

TRANSISTOR DETAIL
(BOTTOM VIEW)

A-13-66
Refinery

MOTOROLA

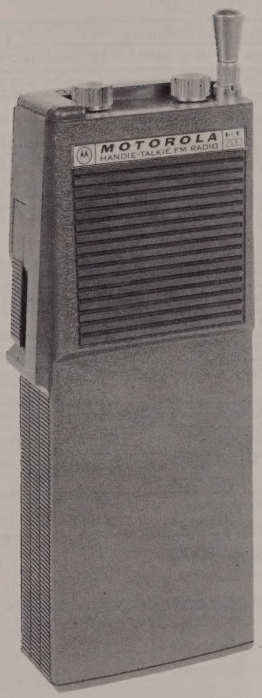
"HANDIE-TALKIE"

FM RADIO

CARRIER AND "PRIVATE-LINE" TONE-CODED SQUELCH

132-174 MC

PORTABLE TRANSISTORIZED



MOTOROLA INC. *Communications Division*

ENGINEERING PUBLICATIONS 4501 WEST AUGUSTA BOULEVARD CHICAGO, ILLINOIS 60651

Copyright 1965 by Motorola, Inc.
Printed in U. S. A.
10/1/65-RCS

68P81032A30
Issue - B

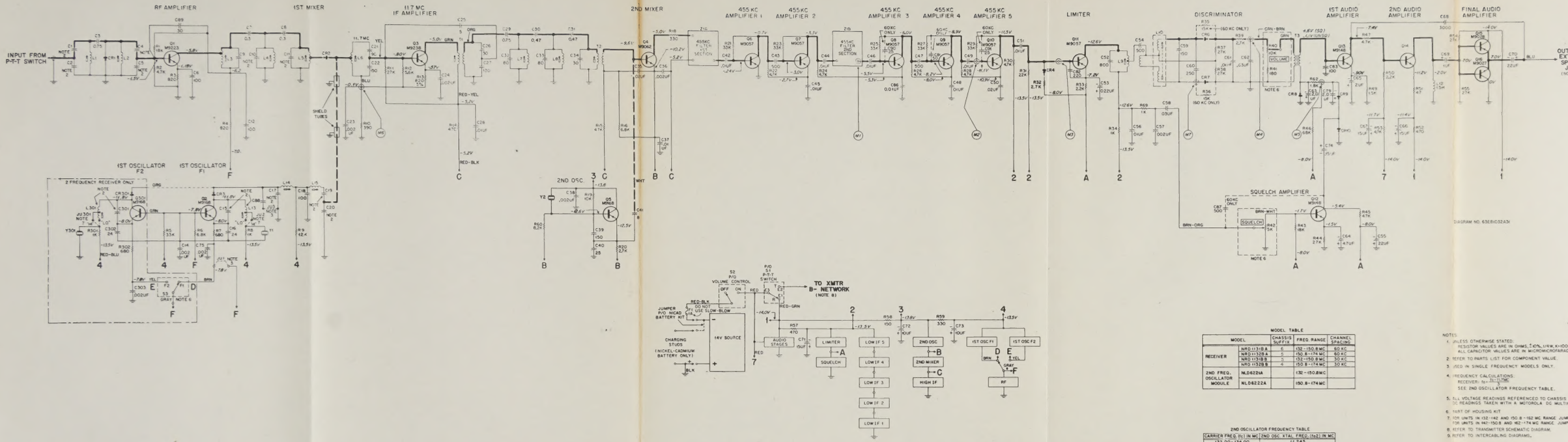


DIAGRAM NO. 63E81032A31

MODEL TABLE

MODEL		CHASSIS SUFFIX	FREQ. RANGE	CHANNEL SPACING
RECEIVER	NRD1131B A	6	132 - 150.8 MC	60 KC
	NRD1132B A	5	150.8 - 174 MC	60 KC
	NRD1131B B	5	132 - 150.8 MC	30 KC
	NRD1132B B	4	150.8 - 174 MC	30 KC
2ND FREQ. OSCILLATOR MODULE	NLD6224A		132 - 150.8 MC	
	NLD6222A		150.8 - 174 MC	

2ND OSCILLATOR FREQUENCY TABLE

CARRIER FREQ. (fc) IN MC	2ND OSC. XTAL FREQ. (fo2) IN MC
132.00 - 134.00	11.245
134.001 - 136.00	12.155
136.001 - 145.00	11.245
145.001 - 145.50	12.155
145.501 - 146.00	11.245
146.001 - 150.80	12.155
150.801 - 157.00	11.245
157.001 - 157.60	12.155
157.601 - 168.00	11.245
168.001 - 169.00	12.155
169.001 - 174.00	11.245

NOTES

1. UNLESS OTHERWISE STATED:
   RESISTOR VALUES ARE IN OHMS, ±10%, 1/4W, K=1000.
   ALL CAPACITOR VALUES ARE IN MICROMICROFARADS.
2. REFER TO PARTS LIST FOR COMPONENT VALUE.
3. JSCI IN SINGLE FREQUENCY MODELS ONLY.
4. FREQUENCY CALCULATIONS:
   RECEIVER: $fo = \frac{fc - 11.7MC}{3}$
   SEE 2ND OSCILLATOR FREQUENCY TABLE.
5. D.C. VOLTAGE READINGS REFERENCED TO CHASSIS GROUND.
   D.C. READINGS TAKEN WITH A MOTOROLA DC MULTIMETER.
6. PART OF HOUSING KIT
7. FOR UNITS IN 132-142 AND 150.8-162 MC RANGE JUMPER TO "LO" CONNECTION
   FOR UNITS IN 142-150.8 AND 162-174 MC RANGE JUMPER TO "HI" CONNECTION
8. REFER TO TRANSMITTER SCHEMATIC DIAGRAM.
9. REFER TO INTERCABLING DIAGRAMS.

TRANSISTOR DETAIL (BOTTOM VIEW)

PREVIOUS REVISIONS LISTED ON BACK OF THIS DIAGRAM

Carrier Squelch Reciever
Schematic Diagram
Motorola No. 63E81032A31-B

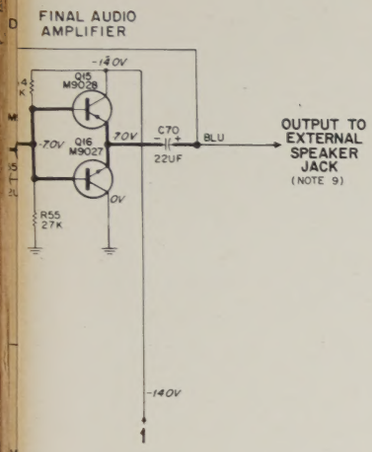


DIAGRAM NO. 63E81032A31

ES:
UNLESS OTHERWISE STATED:
RESISTOR VALUES ARE IN OHMS, ±10%, 1/4W, K=1000.
ALL CAPACITOR VALUES ARE IN MICROMICROFARADS.

REFER TO PARTS LIST FOR COMPONENT VALUE.

USED IN SINGLE FREQUENCY MODELS ONLY.

FREQUENCY CALCULATIONS:
RECEIVER: $f_o = \frac{f_c - 11.7MC}{3}$
SEE 2ND OSCILLATOR FREQUENCY TABLE.

ALL VOLTAGE READINGS REFERENCED TO CHASSIS GROUND.
DC READINGS TAKEN WITH A MOTOROLA DC MULTIMETER.

PART OF HOUSING KIT

FOR UNITS IN 132-142 AND 150.8-162 MC RANGE JUMPER TO "LO" CONNECTION
FOR UNITS IN 142-150.8 AND 162-174 MC RANGE JUMPER TO "HI" CONNECTION

REFER TO TRANSMITTER SCHEMATIC DIAGRAM.

REFER TO INTERCABLING DIAGRAMS.

TRANSISTOR DETAIL
(BOTTOM VIEW)

A-13-66
Refinery

MOTOROLA

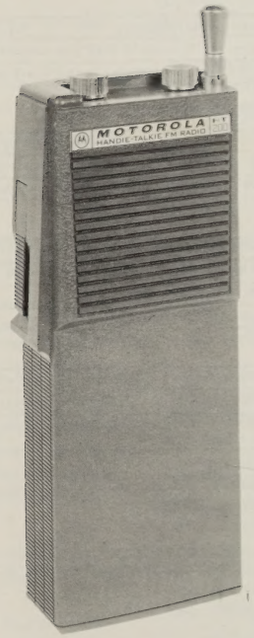
"HANDIE-TALKIE"

FM RADIO

CARRIER AND "PRIVATE-LINE" TONE-CODED SQUELCH

132-174 MC

PORTABLE TRANSISTORIZED



MOTOROLA INC. Communications Division
ENGINEERING PUBLICATIONS 4501 WEST AUGUSTA BOULEVARD CHICAGO, ILLINOIS 60651

Copyright 1965 by Motorola, Inc.
Printed in U.S.A.
10/1/65-RCS

68P81032A30
Issue - B

GUARANTEED PERFORMANCE SPECIFICATIONS

GENERAL

MODELS	H23DEN-1000 Series	H23DEN-3000 Series	H23DEN-1104 Series (external microphone)	H23DEN-3104 Series (external microphone)
POWER SUPPLY	(1) mercury battery, 16.8 volts; or (1) nickel-cadmium battery, 14.4 volts			
BATTERY DRAIN Standby (14.0 v) Receive (14.0 v) Transmit (14.2 v)	4 ma 55 ma 375 ma	9 ma 60 ma 380 ma	4 ma 55 ma 425 ma	9 ma 60 ma 475 ma
BATTERY LIFE (based on 10% transmit, 10% receive with rated audio output, and 80% standby)	Mercury battery 50 hours. Nickel-cadmium battery 8 hours per charge.	Mercury battery 45 hours. Nickel-cadmium battery 8 hours per charge.	Mercury battery 45 hours. Nickel-cadmium battery 8 hours per charge.	Mercury battery 40 hours. Nickel-cadmium battery 8 hours per charge.
DIMENSIONS	1-13/16" x 3-3/8" x 8-1/4"		1-13/16" x 3-3/8" x 9-3/4"	
WEIGHT	With mercury battery, 35 ounces	With mercury battery, 36 ounces	With mercury battery, 39 ounces	With mercury battery, 39 ounces
	With nickel-cadmium battery, 34 ounces	With nickel-cadmium battery, 35 ounces	With nickel-cadmium battery, 38 ounces	With nickel-cadmium battery, 38 ounces

TRANSMITTER

RF OUTPUT	1.6 watts with mercury battery	2.0 watts with nickel-cadmium
FREQUENCY STABILITY	±0.0005% from -30°C to +60°C (+25°C reference)	
MODULATION	16F3: ±5 kc for 100% at 1000 cps; or 36F3: ±15 kc for 100% at 1000 cps	
CRYSTAL MULTIPLICATION	18 times	
SPURIOUS AND HARMONICS	More than 46 db below carrier	
FM NOISE	At least 50 db below ±3.3 kc deviation at 1000 cps, or at least 50 db below ±10 kc deviation at 1000 cps	
AUDIO RESPONSE	+1, -3 db or 6 db/octave pre-emphasis characteristic from 300 to 3000 cps	
AUDIO DISTORTION	Less than 8% at 1000 cps, 2/3 rated maximum deviation	

RECEIVER

MODULATION ACCEPTANCE*	±5 kc (split channel models) or ±15 kc (wide band models)
SENSITIVITY	Less than 0.5 microvolt for 20 db quieting; 0.35 microvolt for 12 db SINAD
SPURIOUS AND IMAGE REJECTION	More than 70 db below carrier
NOISE SQUELCH SENSITIVITY	Noise compensated type: adjustable sensitivity, will open at less than 0.25 microvolt
TONE-CODED SQUELCH SENSITIVITY	Fixed sensitivity will open at less than 0.25 microvolt
AUDIO OUTPUT	500 milliwatts to speaker at less than 10% distortion
FREQUENCY STABILITY	±0.0025% from -30°C to +60°C (+25°C reference)
SELECTIVITY	More than 80 db at ±30 kc measured by the 20 db quieting method; more than 70 db by EIA 2-generator method
CHANNEL SPACING*	30 kc (±5 kc bandwidth) 60 kc (±15 kc bandwidth)

* Tone-coded squelch available in split-channel (16F3) models only

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE
FCC LICENSE DESIGNATION: CC3513A

FOREWORD

NOMENCLATURE

Motorola radio equipment is specifically identified by the model number on the nameplate.

NOTE

Be sure to use the entire model number when making inquiries about your equipment.

Identifiers have been assigned to chassis and kits. Use these identifiers when requesting information or ordering replacements.

A model chart is located in the front of this manual.

PRODUCTION CHANGES

When production and engineering changes are incorporated into the equipment, a revision numeral is assigned to the chassis or kit affected.

Typical Example:
The Model NTD6041AA becomes NTD6041AA-1 with the first revision.

This chassis number complete with revision numeral, if any, is stamped on the chassis at the time of production. The revision numeral becomes an integral part of the chassis identifier.

A schematic diagram number complete with its issue letter is also stamped on each chassis. This establishes direct correlation between the chassis and its schematic. The schematic issue is advanced each time a change occurs in the chassis.

INSTRUCTION MANUAL REVISIONS

Changes which occur after an instruction manual is printed are described in the Instruction Manual Revision. These bulletins give the reader complete information on the change including pertinent parts listing data.

NATIONAL SERVICE ORGANIZATION

Motorola provides a nation-wide service organization. Through its maintenance and installation program Motorola makes available the finest service to those desiring reliable continuous communications on a contract basis.

The largest service organization specializing in mobile communications is Motorola's National Service Organization. Over 800 strategically located, adequately staffed and trained, independently owned and operated stations, manned with several thousand FCC licensed personnel constitute the sub-contracting force.

The administrative forces of area and district service managers and district service representatives are in the direct employ of Motorola.

For your contract service requirements, please contact your local Motorola representative or write to:

National Service Manager
Motorola Communications Division
4501 W. Augusta Blvd., Chicago, Illinois 60651

REPLACEMENT PARTS ORDERING

Motorola maintains parts and service depots and authorized service stations strategically located throughout the country. These facilities are fully equipped to give the finest service.

When ordering replacement parts, the complete number identification of the item must be used whether it be a component, kit or complete chassis. This will fix proper identification and insure receipt of the desired item. Complete number identification should also be used when requesting equipment information.

Crystal orders should specify crystal type number, crystal frequency, carrier frequency and the chassis model number in which the crystal is to be used.

Orders for "Vibrasender", "Vibrasponder" and "Vibrasender-sponder" units should specify the type number and frequency and should identify the owner and operator of the communications system in which these items are to be used.

68P81009A97-F

CAREFUL USE OF THE INSTRUCTION MANUAL AND THE MANY SUGGESTIONS CONTAINED IN IT WILL FURTHER INSURE PROPERLY INSTALLED AND MAINTAINED RADIO EQUIPMENT.

THE EQUIPMENT DESCRIBED IN THIS MANUAL IS MANUFACTURED UNDER ONE OR MORE OF THE FOLLOWING MOTOROLA U.S. PATENTS:

RE-24,110	2,691,560	2,833,994	2,994,844	3,087,999
RE-24,815	2,699,425	2,834,879	3,002,146	3,091,736
2,524,300	2,705,281	2,835,794	3,009,115	3,094,293
2,524,534	2,731,555	2,883,521	3,014,127	3,101,441
2,547,023	2,738,466	2,888,652	3,027,454	3,119,093
2,547,025	2,740,891	2,899,547	3,027,455	3,126,514
2,547,027	2,743,144	2,901,601	3,039,081	3,128,431
2,583,032	2,743,361	2,912,573	3,041,550	3,129,396
2,602,842	2,759,052	2,918,571	3,048,659	3,131,354
2,608,648	2,759,103	2,924,705	3,048,747	3,149,317
2,608,649	2,777,950	2,925,562	3,059,184	3,175,183
2,626,384	2,784,263	2,938,082	3,061,785	3,175,187
2,637,782	2,799,010	2,963,577	3,070,737	3,175,193
2,650,333	2,808,507	2,966,585	3,070,748	3,183,382
2,662,942	2,809,236	2,968,739	3,083,332	3,191,123
2,688,059	2,810,068	2,974,221	3,087,117	3,204,202
2,691,094	2,830,200	2,984,740	3,087,998	3,205,455

Other U.S. Patents Pending

CONTENTS

SECTION	PAGE
Guaranteed Performance Specifications	ii
Radio Set Model Chart	vi
Accessory Table	vii
Accessories	viii
DESCRIPTION AND OPERATION	
Description	1
Pre-Operational Notes	1
Operation	2
BATTERY REPLACEMENT AND CHARGING	
Battery Replacement Procedure	4
NLN6238A Nickel-Cadmium Battery Kit	4
THEORY OF OPERATION	
General	5
Circuit Theory	5
MAINTENANCE	
Test Equipment	8
Use of the Test Jig	10
Test Procedure	10
Disassembly Procedure	11
Receiver Stage Analysis	13
Transmitter Service Notes	14
Repair Techniques	15
SERVICE CHARTS AND DIAGRAMS	
Transmitter Alignment Procedure	17
IDC Adjustment Procedure	18
Receiver Alignment Procedure	21
Intercabling Diagram for Carrier Squelch Models With Internal Microphone Only	23
Intercabling Diagram for Carrier Squelch Models With External/Internal Microphone	25
Intercabling Diagram for "Private-Line" Tone-Coded Squelch Models With Internal Microphone Only	27
Intercabling Diagram for "Private-Line" Tone-Coded Squelch Models With External/Internal Microphone	29
"Private-Line" Deck Schematic Diagram and Printed Circuit Board Detail	31
Carrier Squelch Receiver Schematic Diagram and Parts List	34
Carrier Squelch Receiver Printed Circuit Board and Wiring Diagram	35
"Private-Line" Tone-Coded Squelch Receiver Printed Circuit Board and Wiring Diagram	36
"Private-Line" Tone-Coded Squelch Receiver Schematic Diagram and Parts List	37
Transmitter Schematic Diagram and Parts List	39
Transmitter Printed Circuit Board and Wiring Diagram	41

MOTOROLA

MODEL CHART

HT SERIES (HT200)

"HANDIE-TALKIE" FM RADIO

132-174 MC

CODE:

X = ONE ITEM SUPPLIED

2 = TWO ITEMS SUPPLIED

/ = ONE ITEM SUPPLIED PER FIVE (OR LESS) RADIO SETS

*REPRESENTS A SERIES OF MODELS AND NOT A SPECIFIC MODEL. THE SPECIFIC MODEL, AS STAMPED ON THE CHASSIS, IS DETERMINED BY ITS APPLICATION.

ITEM	DESCRIPTION	REFERENCE DIAGRAM	MODEL NUMBER	XMTR. FREQS.	RCVR FREQS.	CHANNEL SPACING	TYPE OF SQUELCH
			INTERNAL MICROPHONE (ONLY) MODELS				
			H23DEN-1000A	1	1	60 KC	CARRIER
			H23DEN-1010A	1	1	60 KC	CARRIER
			H23DEN-1030A	1	2	60 KC	CARRIER
			H23DEN-1100A	1	2	30 KC	CARRIER
			H23DEN-1110A	2	1	30 KC	CARRIER
			H23DEN-1130A	2	2	30 KC	CARRIER
			H23DEN-3100A	1	1	30 KC	TONE-CODED
			H23DEN-3110A	2	1	30 KC	TONE-CODED
			EXTERNAL/INTERNAL MICROPHONE (UNIVERSAL) MODELS				
			H23DEN-1004A	1	1	30 KC	CARRIER
			H23DEN-1014A	1	1	30 KC	CARRIER
			H23DEN-1134A	1	2	30 KC	CARRIER
			H23DEN-3104A	1	1	30 KC	TONE-CODED
			H23DEN-3114A	2	1	30 KC	TONE-CODED
			RIGID LOOP ANTENNA MODELS				
			R23DEN-1100A	1	2	30 KC	CARRIER
			R23DEN-1110A	1	1	30 KC	CARRIER
			R23DEN-1130A	2	2	30 KC	CARRIER
			R23DEN-3100A	1	1	30 KC	TONE-CODED
			R23DEN-3110A	2	1	30 KC	TONE-CODED
*NTD6150AA	TRANSMITTER (NTD6151AA 132-150.8 MC, NTD6152AA 150.8-174 MC)	63E81032A32	X X X X X X X X		X X X X X		X X X X X
*NRD1130BA	RECEIVER, CARRIER SQUELCH, 60 KC CHANNEL SPACING	63E81032A31	X X X				
*NRD1130BB	RECEIVER CARRIER SQUELCH, 30 KC CHANNEL SPACING	63E81032A31		X X X			X X X
*NRD1130BF	RECEIVER DUAL SQUELCH	63E81032A34			X X		X X
*NLD6220A	RECEIVER OSCILLATOR DECK (NLD6221A 132-150.8 MC,						
	NLD6222A 150.8-174 MC)	63E81032A31		X	X		X
NLN6415A	TRANSMITTER 2ND OSCILLATOR DECK	63E81032A32	X X	X X	X	X	X X X
NLD6210A	"PRIVATE-LINE" SQUELCH DECK				X X		X X
TLN6492BA	"VIBRASPONDER" UNIT				X X		X X
NLN6416A	MISCELLANEOUS PARTS & REM. MICROPHONE					X X X X X	
NLN6326A	MISCELLANEOUS PARTS (2 FREQ. TRANSMIT, 1 FREQ. RECEIVE)		X X	X X		X X	X X
NLN6327A	MISCELLANEOUS PARTS (2 FREQ. TRANSMIT, 2 FREQ. RECEIVE)			X	X		X
NLN6424A	UNIT HARDWARE KIT				X X	X	X
NLN6331A	REAR COVER (UNIVERSAL MODELS)					X X X X X	
NLN6236A	REAR COVER		X X X X X X X X				X X X X X X
NLD6230A	TRANSMITTER CRYSTAL KIT		X 2 2 X 2 2 X 2			X 2 2 X 2	X 2 2 X 2
YMW-35	RECEIVER CONTROL CRYSTAL		X X 2 X X 2 X X			X X 2 X X	X X 2 X X
YNW	IF CRYSTAL (11.245 MC)		X X X X X X X X			X X X X X	X X X X X
NHN6068B	HOUSING: ONE FREQUENCY, CARRIER SQUELCH	63C81012A31	X X				
NHN6069B	HOUSING: TWO FREQUENCY, CARRIER SQUELCH	63C81012A31	X X	X			
NHN6070B	HOUSING: ONE FREQUENCY, TONE-CODED SQUELCH	63C81032A33			X		
NHN6071B	HOUSING: TWO FREQ. XMIT, ONE FREQ. REC. TONE-CODED SQUELCH	63C81032A33			X		
NHN6078B	HOUSING & ANTENNA; ONE FREQUENCY, CARRIER SQUELCH	63C81012A31					X
NHN6079B	HOUSING & ANTENNA; TWO FREQUENCY, CARRIER SQUELCH	63C81012A31					X X
NHN6149A	HOUSING & ANTENNA; ONE FREQ. TONE-CODED SQUELCH	63C81032A33					X
NHN6081A	HOUSING & ANTENNA; TWO FREQUENCY, TONE-CODED SQUELCH	63C81032A33					X
NHN6101B	HOUSING: ONE FREQUENCY, CARRIER SQUELCH, EXTERNAL MIC.	63D81023A83				X	
NHN6102B	HOUSING: TWO FREQUENCY, CARRIER SQUELCH, EXTERNAL MIC.	63D81023A83				X X	
NHN6104B	HOUSING: ONE FREQ. TONE-CODED SQUELCH, EXTERNAL MICROPHONE	63D81032A39				X	
NHN6105A	HOUSING; TWO FREQ. XMIT, ONE FREQ. REC., TONE-CODED SQUELCH	63C81032A33				X	
NLN6245A	TUNING TOOLS		/ / / / / / / /			/ / / / /	/ / / / /

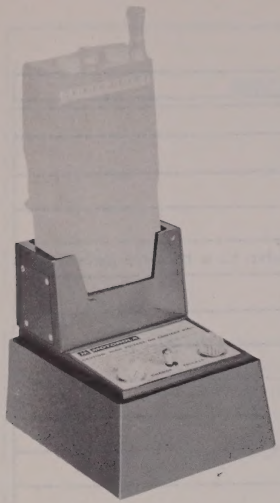
EPD-11707-C

ACCESSORY TABLE

MODEL	DESCRIPTION
NAD6082B	Telescopic Antenna (18-1/2")
NAD6092A	Whip Antenna (18-1/2")
NAD6160A	Tilted Antenna (18-1/2")
NAD6170A	Flexible Antenna (18-1/2")
NKN6065A	Plug-In Mobile Antenna Adapter Cable (for connecting the radio to a mobile antenna)
NSN6008A	Plug-In Lapel Speaker
NSN6009A	Plug-In Earpiece
NMN6021B*	Speaker-Microphone (with coil cord)
NMN6022B*	Speaker-Microphone (with straight cord, antenna in cord)
NMN6023B*	Microphone (with coil cord)
NMN6024B*	Microphone (with straight cord)
NMN6027B*	Microphone, noise cancelling (straight cord)
NMN6028A*	Microphone, noise cancelling (coil cord)
NLN6042A	Black Leather Belt
NLN6352A	Sam Browne Belt (canvas, black, with microphone hang-up bracket)
NLN6350A	Safety Lanyard
NLN6349A	Carrying Strap
NLN6253A	Carrying Strap Cord and Swivel Assembly Kit
NLN6316A**	Carrying Case (black)
NLN6318A**	Solid Carrying Case Cover (black)
NLN6353A	Chest Pack with Straps (canvas, black)
NLN6320A**	Perforated and Slit Cover (black)
NLN6343A*	Carrying Case (use NLN6322A Case Cover)
NLN6322A	Rigid Loop Case Cover (black)
NEN6049A	Test Jig
NLN6259A	Battery Charger for recharging nickel-cadmium battery. The battery may be charged while in or out of the radio.
NLN6354A	Vehicular Battery Charger (radio set becomes a portable-mobile unit when in the charger)
NLN6238A	Rechargeable Nickel-Cadmium Battery Kit
NLN6239A	Mercury Battery Kit (Mallory part number 303314)
NLN6260A	Multiple Unit Battery Charger
NLN6477A	Alkaline Battery Kit

*For H23DEN-1104A, -1114A, -1134A, -3104A and -3114A models only.
**For H23DEN-1000A, -1010A, -1030A, -1100A, -1110A, -1130A, -3100A and -3110A models only.

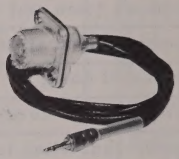
ACCESSORIES



NLN6259A UNIT
BATTERY CHARGER

NAD6082B
TELESCOPIC ANTENNA

NSN6008A
LAPEL SPEAKER

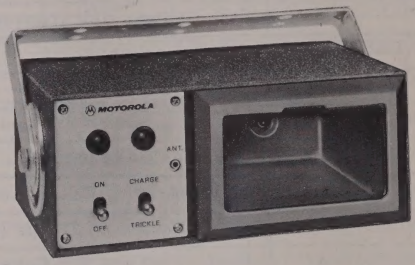


NKN6065A
ADAPTER CABLE

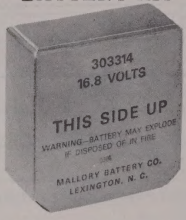
NAD6092A
WHIP ANTENNA

NSN6009A
EARPIECE

NLN6238A NICKEL-CADMIUM
BATTERY KIT



NLN6354A VEHICULAR
BATTERY CHARGER



NLN6239A MERCURY
BATTERY KIT

NLN6316A CARRYING CASE
WITH
NLN6320A PERFORATED
AND SLIT COVER

NMN6023A
EXTERNAL MICROPHONE
(NMN6024A HAS STRAIGHT
CORD)

NMN6022A
EXTERNAL
SPEAKER-MICROPHONE
(NMN6021A HAS COIL CORD)

3. OPERA

a. To Tu

Turn t
rection unt
receiver in

b. To Adj

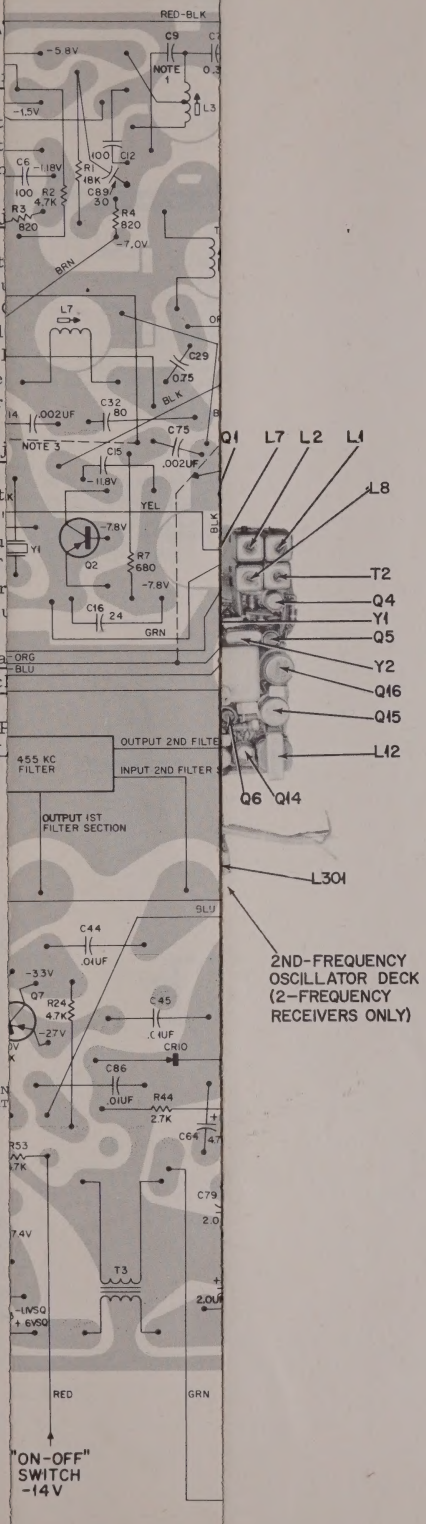
Turn t
wise. On d
Line" ON-
"Universal
the INT. -
the volume
obtained fr

c. To Adj

Turn t
wise. On
models, tu
to the OFF
ceived, tur
the noise ju

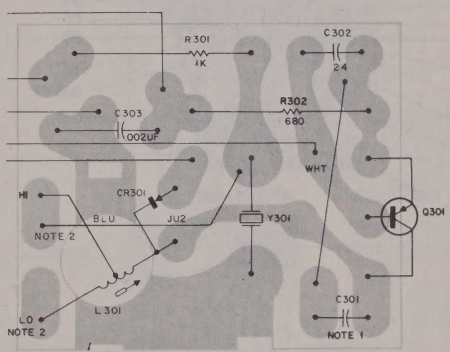
d. "Priva
Squelc

For "F
"Private-L



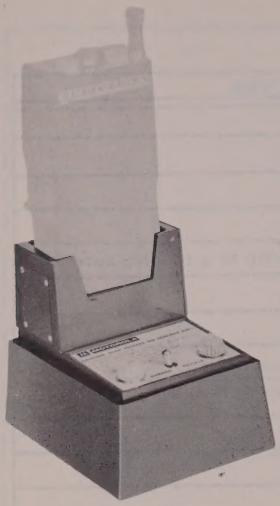
REVISIONS

DIAG. ISSUE	BOARD AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
A	NRD1131BB-1 NRD1131BA-1	C31	WAS 21C82450B22, 0.75 uuf	UPPER LEFT OF BOARD
	NRD1132BB-1 NRD1132BA-1	R9	WAS 6K128903, 39K	UPPER RIGHT OF BOARD
B	NRD1131BB-2 NRD1131BA-2	C9L	WAS 21K861430	
		L3L	INCLUDED COIL WAS 24C82711H01; WAS V10-RED	UPPER CENTER OF BOARD
C	NRD1131BA-2 NRD1132BA-1 NRD1131BB-2 NRD1132BB-1	Q3	WAS 48R869169 TYPE M9169	HIGH IF AMPL. MODULE
		C25	WAS 21D82877B08; 2.8 uuf	
	NRD1131BA-3 NRD1132BA-2 NRD1131BB-3 NRD1132BB-2		455 KC FILTERS WERE MODELS NFN6004AS, AW	CENTER OF RECEIVER BOARD
D	NRD1131BA-4 NRD1132BA-3 NRD1131BB-4 NRD1132BB-3	Q1	WAS 48R869029 TYPE M9029	TOP-CENTER OF RECEIVER BOARD
		R2	WAS 6K129225; 10K	
		C89	ADDED	Q1 BASE CIRCUIT
E	NRD1131BA-5 NRD1132BA-4	C81	WAS 21K864013, 50 uuf for 60 KC	Q9 COLLECTOR
		C90	ADDED 25 uuf FOR 60 KC	Q8 BASE
		C91	ADDED 25 uuf FOR 60 KC	Q10 BASE
F	NRD1131BB-5 NRD1132BB-4 NRD1131BA-6 NRD1132BA-5	R37	WAS 1/4 W	PARTS LIST
G	NLD6221A NLD6222A		REVISED PRINTED CIRCUIT BOARD CIRCUIT WAS AS SHOWN BELOW	2ND FREQ. OSC.

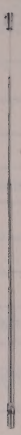


132-174 MC "Handie-Talkie" FM Radio
Carrier Squelch Receiver
Printed Circuit Board & Wiring Diagram
Motorola No. EPD-10461-G

ACCESSORIES



NLN6259A UNIT
BATTERY CHARGER



NAD6082B
TELESCOPIC ANTENNA

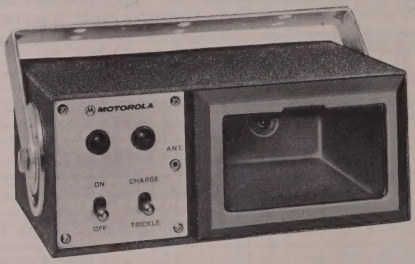
NSN6008A
LAPEL SPEAKER

NKN6065A
ADAPTER CABLE

NAD6092A
WHIP ANTENNA

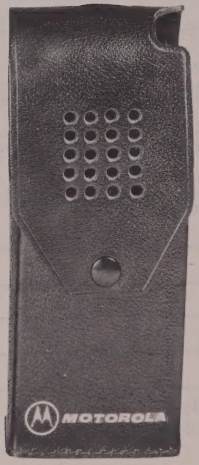
NSN6009A
EARPIECE

NLN6238A NICKEL-CADMIUM
BATTERY KIT



NLN6354A VEHICULAR
BATTERY CHARGER

NLN6239A MERCURY
BATTERY KIT



NLN6316A CARRYING CASE
WITH
NLN6320A PERFORATED
AND SLIT COVER

NMN6023A
EXTERNAL MICROPHONE
(NMN6024A HAS STRAIGHT
CORD)

NMN6022A
EXTERNAL
SPEAKER-MICROPHONE
(NMN6021A HAS COIL CORD)

3. OPERATION

a. To Turn On

Turn the volume control in a clockwise direction until a "click" is heard. This places the receiver in operation.

b. To Adjust Receiver Audio Volume

Turn the squelch control fully counterclockwise. On dual squelch models, turn the "Private-Line" ON-OFF switch to the OFF position. On "Universal" (external microphone) models, put the INT. -EXT. speaker switch on INT. Adjust the volume control until the desired volume is obtained from the speaker.

c. To Adjust Squelch Control

Turn the squelch control fully counterclockwise. On "Private-Line" tone-coded squelch models, turn the "Private-Line" ON-OFF switch to the OFF position. With no signal being received, turn the squelch control clockwise until the noise just cuts out (squelches).

d. "Private-Line" Operation Tone-Coded Squelch Models Only

For "Private-Line" operation, place the "Private-Line" ON-OFF switch in the ON position. All non-"Private-Line" and incorrectly coded "Private-Line" signals will not be heard. The squelch control is inoperative when the "Private-Line" ON-OFF switch is in the ON position and does not require adjustment.

NOTE

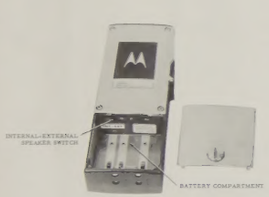
Before transmitting, momentarily place the "Private-Line" ON-OFF switch in the OFF position. This enables the operator to check for a clear channel and thus avoid breaking in on the transmission of another on-frequency unit.

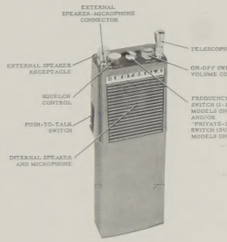
e. To Monitor

To monitor all "on-frequency" transmissions, turn the unit on and adjust the VOLUME and SQUELCH controls to the proper levels. On dual squelch models, the "Private-Line" ON-OFF switch must be OFF. To monitor only "Private-Line" transmissions, the "Private-Line" ON-OFF switch must be ON. The antenna should be extended for maximum sensitivity. However, for short range operation, reception can be obtained with the antenna collapsed.

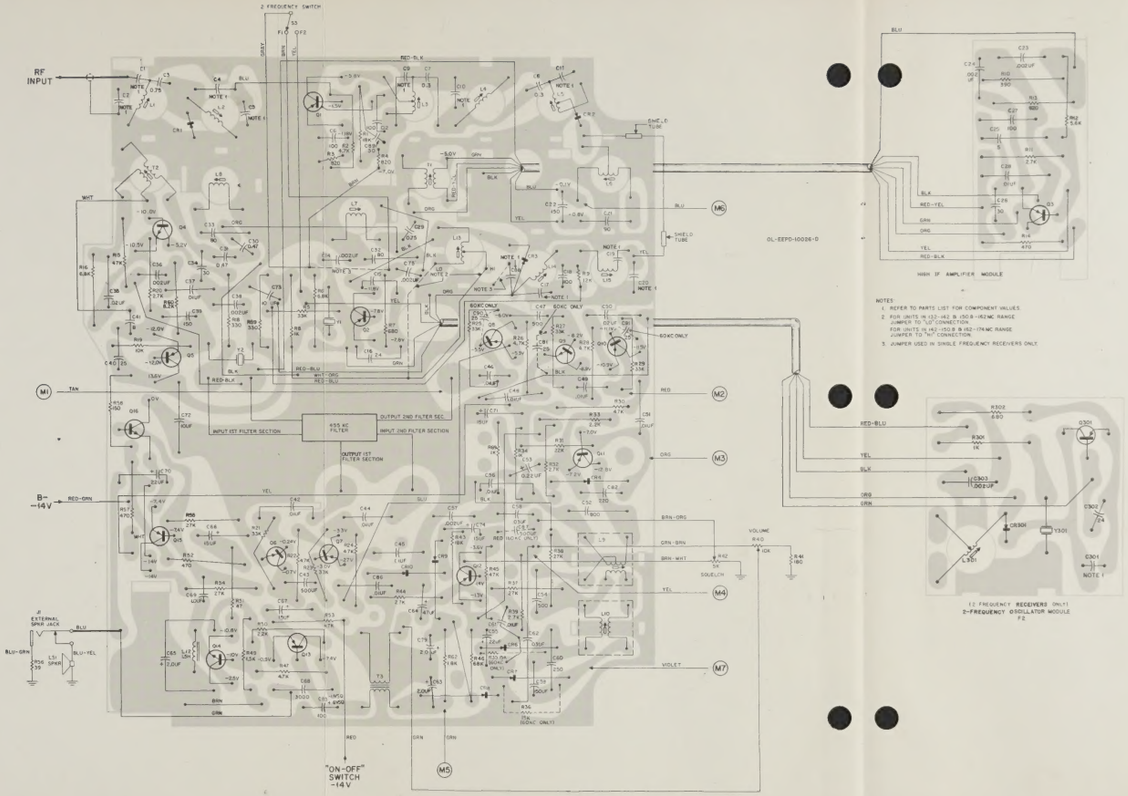
f. To Transmit

Extend the antenna and hold the speaker grill approximately one to two inches from the lips.

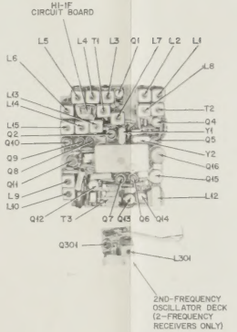



EXTERNAL SPEAKER-MICROPHONE CONNECTOR
EXTERNAL SPEAKER RECEPTACLE
SQUELCH CONTROL
PUSH-TO-TALK SWITCH
INTERNAL SPEAKER AND MICROPHONE
TELESCOPIC ANTENNA
ON-OFF SWITCH AND VOLUME CONTROL
FREQUENCY SELECTOR SWITCH (5-FREQUENCY MODELS ONLY) AND/OR "PRIVATE-LINE" ON-OFF SWITCH (DUAL SQUELCH MODELS ONLY)

Controls Location Details



NOTES:
1. REFER TO PARTS LIST FOR COMPONENT VALUES.
2. FOR UNITS IN 132-142 & 150.8-162 MC RANGE JUMPER TO "G" CONNECTION. FOR UNITS IN 142-150.8 & 162-174 MC RANGE JUMPER TO "H" CONNECTION.
3. JUMPER USED IN SINGLE FREQUENCY RECEIVERS ONLY.



REVISIONS

DIAG ISSUE	BOARD AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
A	NRD1131BB-1 NRD1131BA-1 NRD1132BB-1 NRD1132BA-1	C51	WAS 21GR405P24, 5.75 mf WAS 21GR405P24, 39K	UPPER LEFT OF BOARD UPPER RIGHT OF BOARD
B	NRD1131BB-2 NRD1131BA-2	C5L L3L	WAS 21BX51A35 INCLUDED COIL WAS 24CR427-10901, WAS 920-R DC	UPPER CENTER OF BOARD
C	NRD1131BA-3 NRD1132BA-3 NRD1131BB-3 NRD1132BB-3 NRD1132BD-1	Q3 C25 	WAS 48R485135 TYPE M3165 WAS 21DR267B06, 5.6 mmf 455 KC FILTERS WERE MODELS NFM6066AS, AW	HIGH IF AMPL. MODULE CENTER OF RECEIVER BOARD
D	NRD1131BA-4 NRD1132BA-4 NRD1131BB-4 NRD1132BB-4	Q1 C29	WAS 48R485025 TYPE M5025 ADDED	TOP-CENTER OF RECEIVER BOARD CIRCUIT
E	NRD1131BA-5 NRD1132BA-5	C81 C55 C51 C55	WAS 21KR64011, 50 mmf for 50 KC ADDED 25 mmf FOR 50 KC ADDED 25 mmf FOR 50 KC	Q8 BASE Q10 BASE
F	NRD1131BB-5 NRD1132BB-5 NRD1131BA-5 NRD1132BA-5	R37	WAS 1/4 W	PARTS LIST
G	NLD6331A NLD6332A		REVISED PRINTED CIRCUIT BOARD. CIRCUIT WAS AS SHOWN BELOW	2ND FREQ. OSC.

132-174 MC "Handie-Talkie" FM Radio
Carrier Squelch Receiver
Printed Circuit Board & Wiring Diagram
Motorola No. EPD-10461-G

DESCRIPTION AND OPERATION

1. DESCRIPTION

a. General

The completely transistorized Motorola "Handie-Talkie" FM radio described in this manual is a portable, hand-held, two-way communications unit. It is a battery powered radio capable of two-way communications with any FM radio set within range and operating on the same frequency. The unit is weatherproof and may be carried in a pocket. The radio provides 2.0 watts r-f using the nickel-cadmium battery.

These radios incorporate a new concept in miniaturized circuitry, made possible by arranging components in discrete "decks" or layers on the printed circuit boards. As many as three layers are used in some portions of the unit.

b. "Private-Line" Feature

Motorola "Private-Line" tone-coded squelch radios are especially useful when operating under crowded channel conditions. Several networks may share the same carrier frequency in the same area with a minimum of interference when each network uses a different "Private-Line" tone code frequency.

The "Private-Line" Squelch Deck contains circuitry required for both transmitter and receiver "Private-Line" operation. The transmitter portion consists essentially of a tone oscillator which is actuated when the push-to-talk button on the radiophone is pressed. The transmitter is then modulated by a continuous audio tone signal in addition to the voice message.

The receiver portion of the "Private-Line" squelch deck consists essentially of a decoder. With the "Private-Line" circuit "on", only properly coded messages will be heard at the speaker. Uncoded or improperly coded signals will be excluded.

c. External Microphone and Speaker-Microphone Feature

Motorola "Universal" (external speaker-microphone) "Handie-Talkie" FM Radios permit two-way communication while the radio is carried at the side of the user. The external microphone is attached to the radio by a cord and has a built-in push-to-talk switch. A hang-up button allows the microphone to be easily attached to the radio carrying case or to a shoulder strap.

The external microphones are available with or without speakers. An external speaker-microphone allows the user to listen to incoming messages at the microphone instead of the radio. A switch in the radio transfers the incoming message from the speaker in the radio to the speaker in the speaker-microphone. Both types of microphones are available with coil cords or straight cords.

The external microphone (or speaker-microphone) is equipped with a push-to-talk switch similar to that on the radio, and actuates only the external microphone. The radio push-to-talk switch actuates only the internal microphone and overrides the external push-to-talk switch. The "Universal" radio will operate as a "Standard" radio if not equipped with an external microphone.

The "Universal" FM "Handie-Talkie" Radio equipped with an external speaker-microphone, becomes a mobile-portable two-way radio when the Model NLN6354A Vehicular Charger is used. When the radio is placed in the charger all radio controls are readily available. There is a microphone hang-up bracket on the bottom of the charger and an antenna cord for connecting the radio to the automobile antenna. During such use, the internal nickel-cadmium battery of the radio is being charged by the vehicle's electrical system. For portable use, it is necessary to merely unplug the antenna cord, remove the radio from the charger, and replace the radio's telescopic whip, or rigid loop antenna.

2. PRE-OPERATIONAL NOTES

Use care when unpacking and handling the "Handie-Talkie" radio. Open the shipping carton and carefully remove all items. Check the contents to be sure that all items have been included.

Inspect the equipment thoroughly as soon as possible after delivery. If any part of the equipment has been damaged in transit, report the extent of damage to the transportation company immediately.

IMPORTANT

This radio contains a battery. Extended storage of the equipment will reduce the operating performance due to reduction in battery voltage and life. If equipment is to be stored for a long period of time, remove the battery and store it in a cool place.

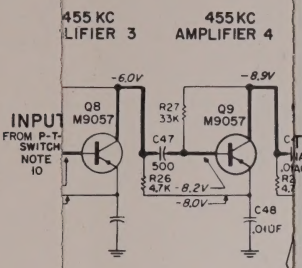
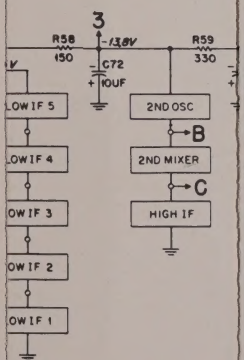


DIAGRAM NO. 6



2ND OSCILLATOR FREQUENCY TABLE

CARRIER FREQ. (f_C) IN MC	2ND OSC. XTAL. FREQ. . (f_O2) IN MC
132.00-134.00	11.245
134.001-136.00	12.155
136.001-145.00	11.245
145.001-145.50	12.155
145.501-146.00	11.245
146.001-150.80	12.155
150.801-157.00	11.245
157.001-157.60	12.155
157.601-168.00	11.245
168.001-169.00	12.155
169.001-174.00	11.245

MODEL TABLE

MODEL		CHASSIS SUFFIX	FREQ. RANGE	NO. OF FREQ.	ANTENNA
RECEIVER	NRD1131BF	5	132-150.8 MC	2	
	NRD1132BF	4	150.8-174 MC	2	

NOTES:

1. UNLESS OTHERWISE STATED:
   RESISTOR VALUES ARE IN OHMS, K=1000
   ALL CAPACITOR VALUES ARE IN MICROMICROFARADS
2. REFER TO PARTS LIST FOR COMPONENT VALUE.
3. USED IN SINGLE FREQUENCY MODELS ONLY.
4. FREQUENCY CALCULATIONS:

   RECEIVER: $f_o = \frac{f_c - 11.7\ MC}{3}$

   SEE 2ND OSCILLATOR FREQUENCY TABLE.

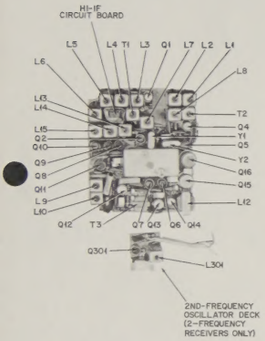
5. ALL VOLTAGE READINGS REFERENCED TO CHASSIS GROUND. DC READINGS TAKEN WITH A MOTOROLA DC MULTIMETER.
6. PART OF HOUSING KIT.
7. S2 IS PART OF VOLUME CONTROL (R40).
8. 132-142 MC AND 150.8-162 MC CONNECT JU2 TO POSITION "LO". 142-150.8 MC AND 162-174 MC CONNECT JU2 TO POSITION "HI".
9. REFER TO INTERCABLING DIAGRAMS.
10. REFER TO TRANSMITTER SCHEMATIC DIAGRAM.
11. E1, E2 AND E3 REFER TO CONTACTS ON THE P-T-T SWITCH (INTERNAL MIC ONLY MODELS).
    R1, R2 AND R3 REFER TO CONTACTS ON THE P-T-T RELAY (EXT/INT MIC MODELS).

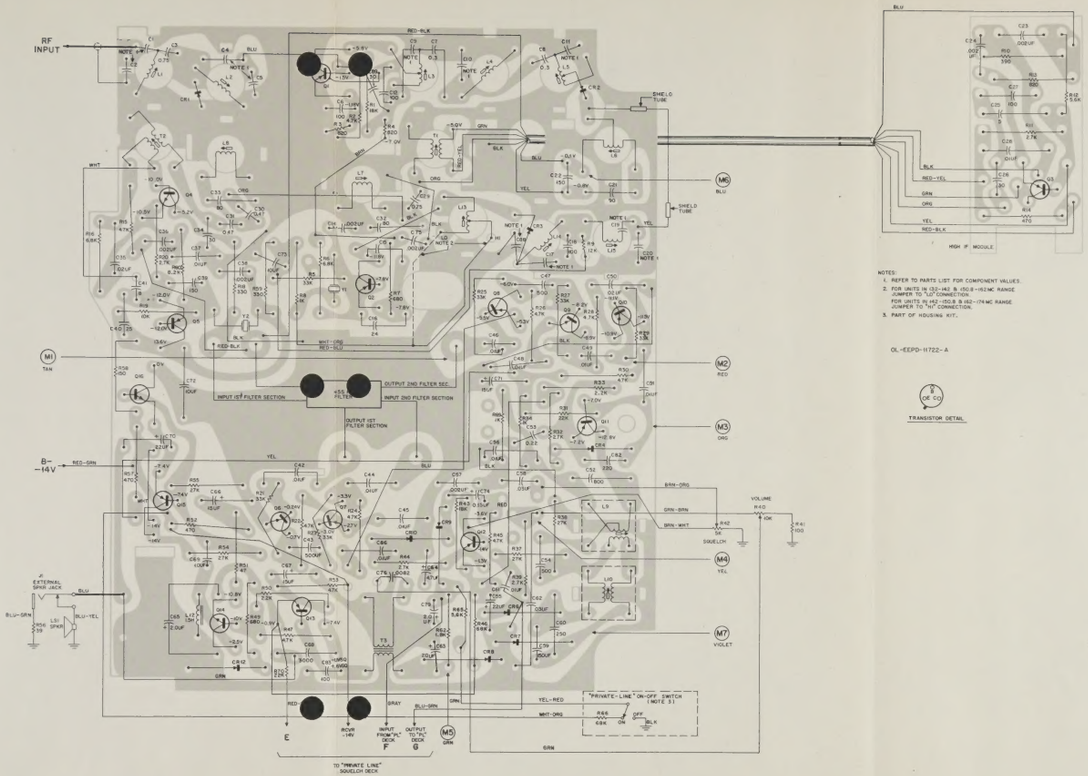
EPD-11892-A

"Private-Line" Tone-Coded Squelch
Receiver Schematic Diagram
Motorola No. 63E81032A34-B

REVISIONS

DIAG ISSUE	BOARD AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
A	NRD1131BF-5 NRD1132BF-4	R37	WAS 6R127B06 1/4 W	LOWER RIGHT OF BOARD





NOTES:
1. REFER TO PARTS LIST FOR COMPONENT VALUES.
2. FOR UNITS IN (32-46) & (50.8-61)MC RANGE JUMPER TO "LO" CONNECTION.
   FOR UNITS IN (42-50.8 & (62-74 MC RANGE JUMPER TO "HI" CONNECTION.
3. PART OF HOUSING KIT.

OL-EEPD-11722-A

"Private-Line" Tone-Coded Squelch Receiver
Printed Circuit Board and Wiring Diagram
Motorola No. EPD-11723-A

DESCRIPTION AND OPERATION

1. DESCRIPTION

a. General

The completely transistorized Motorola "Handie-Talkie" FM radio described in this manual is a portable, hand-held, two-way communications unit. It is a battery powered radio capable of two-way communications with any FM radio set within range and operating on the same frequency. The unit is weatherproof and may be carried in a pocket. The radio provides 2.0 watts r-f using the nickel-cadmium battery.

These radios incorporate a new concept in miniaturized circuitry, made possible by arranging components in discrete "decks" or layers on the printed circuit boards. As many as three layers are used in some portions of the unit.

b. "Private-Line" Feature

Motorola "Private-Line" tone-coded squelch radios are especially useful when operating under crowded channel conditions. Several networks may share the same carrier frequency in the same area with a minimum of interference when each network uses a different "Private-Line" tone code frequency.

The "Private-Line" Squelch Deck contains circuitry required for both transmitter and receiver "Private-Line" operation. The transmitter portion consists essentially of a tone oscillator which is actuated when the push-to-talk button on the radiophone is pressed. The transmitter is then modulated by a continuous audio tone signal in addition to the voice message.

The receiver portion of the "Private-Line" squelch deck consists essentially of a decoder. With the "Private-Line" circuit "on", only properly coded messages will be heard at the speaker. Uncoded or improperly coded signals will be excluded.

c. External Microphone and Speaker-Microphone Feature

Motorola "Universal" (external speaker-microphone) "Handie-Talkie" FM Radios permit two-way communication while the radio is carried at the side of the user. The external microphone is attached to the radio by a cord and has a built-in push-to-talk switch. A hang-up button allows the microphone to be easily attached to the radio carrying case or to a shoulder strap.

The external microphones are available with or without speakers. An external speaker-microphone allows the user to listen to incoming messages at the microphone instead of the radio. A switch in the radio transfers the incoming message from the speaker in the radio to the speaker in the speaker-microphone. Both types of microphones are available with coil cords or straight cords.

The external microphone (or speaker-microphone) is equipped with a push-to-talk switch similar to that on the radio, and actuates only the external microphone. The radio push-to-talk switch actuates only the internal microphone and overrides the external push-to-talk switch. The "Universal" radio will operate as a "Standard" radio if not equipped with an external microphone.

The "Universal" FM "Handie-Talkie" Radio equipped with an external speaker-microphone, becomes a mobile-portable two-way radio when the Model NLN6354A Vehicular Charger is used. When the radio is placed in the charger all radio controls are readily available. There is a microphone hang-up bracket on the bottom of the charger and an antenna cord for connecting the radio to the automobile antenna. During such use, the internal nickel-cadmium battery of the radio is being charged by the vehicle's electrical system. For portable use, it is necessary to merely unplug the antenna cord, remove the radio from the charger, and replace the radio's telescopic whip, or rigid loop antenna.

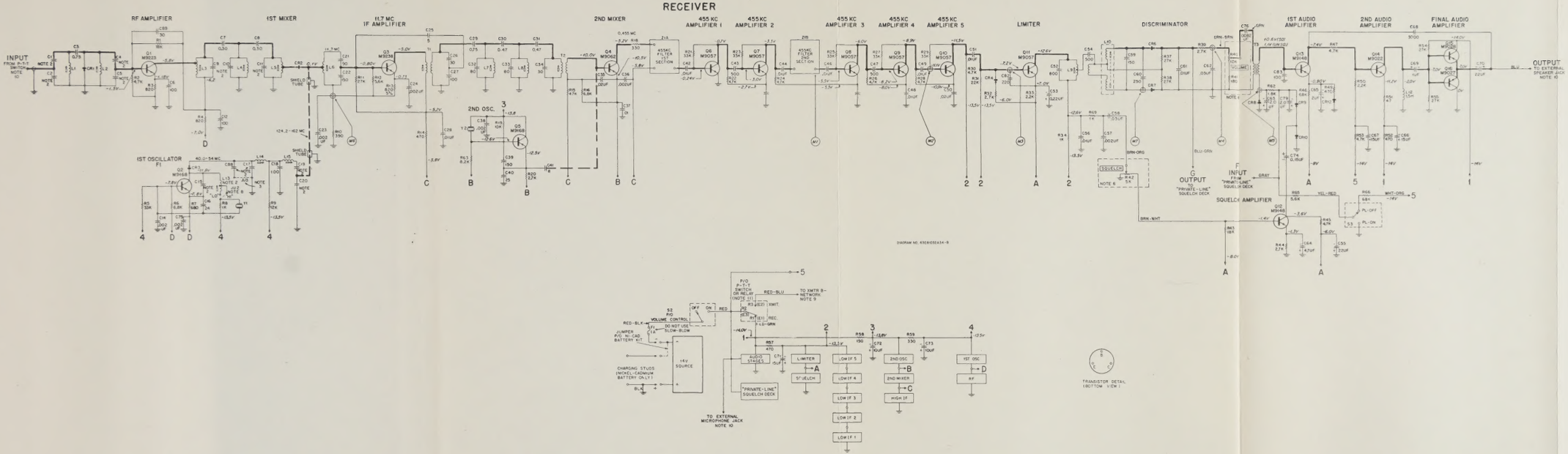
2. PRE-OPERATIONAL NOTES

Use care when unpacking and handling the "Handie-Talkie" radio. Open the shipping carton and carefully remove all items. Check the contents to be sure that all items have been included.

Inspect the equipment thoroughly as soon as possible after delivery. If any part of the equipment has been damaged in transit, report the extent of damage to the transportation company immediately.

IMPORTANT

This radio contains a battery. Extended storage of the equipment will reduce the operating performance due to reduction in battery voltage and life. If equipment is to be stored for a long period of time, remove the battery and store it in a cool place.



2ND OSCILLATOR FREQUENCY TABLE

CARRIER FREQ. (fc) IN MC	2ND OSC. XTAL FREQ. (fx2) IN MC
132.00-134.00	11.245
134.001-136.00	11.255
136.001-145.00	11.245
145.001-145.50	11.255
145.501-146.00	11.245
146.001-150.80	11.255
150.801-157.00	11.245
157.001-157.50	11.255
157.501-168.00	11.245
168.001-169.00	11.255
169.001-174.00	11.245

MODEL TABLE

MODEL		CHASSIS SUFFIX	FREQ. RANGE	NO. OF CHANNELS	ANTENNA
RECEIVER	NRD1111BF	8	132-150.8 MC	4	
	NRD1112BF	9	150.8-174.000 MC	4	

NOTES:

1. UNLESS OTHERWISE STATED:
   RESISTOR VALUES ARE IN OHMS, K=1000
   ALL CAPACITOR VALUES ARE IN MICROMICROFARADS
2. REFER TO PARTS LIST FOR COMPONENT VALUE.
3. USED IN SINGLE FREQUENCY MODELS ONLY.
4. FREQUENCY CALCULATIONS:

   RECEIVER: $f_c = \frac{f_x - 11.7\ MC}{3}$

   SEE 2ND OSCILLATOR FREQUENCY TABLE.

5. ALL VOLTAGE READINGS REFERENCED TO CHASSIS GROUND. DC READINGS TAKEN WITH A MOTOROLA DC MULTIMETER.
6. PART OF HOUSING R2T.
7. R2 IS PART OF VOLUME CONTROL (R48).
8. 132-142 MC AND 150.8-162 MC CONNECT J102 TO POSITION "LO". 142-150.8 MC AND 162-174 MC CONNECT J102 TO POSITION "HI".
9. REFER TO INTERCABLING DIAGRAMS.
10. REFER TO TRANSMITTER SCHEMATIC DIAGRAM.
11. E1, E2 AND E3 REFER TO CONTACTS ON THE P-T-T SWITCH (INTERNAL MIC ONLY MODELS).
    K1, K2 AND K3 REFER TO CONTACTS ON THE P-T-T RELAY (EXT/INT MIC MODELS).

EPD-11892-A

"Private-Line" Tone-Coded Squelch
Receiver Schematic Diagram
Motorola No. 63E81032A34-B

R TO BOARD
1718-A
1718-B
1718-C
1718-D
1718-E

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

NLN6415A XMTR. Osc. (F2) EPD-12134-A

		CAPACITOR, fixed: uuf
C201	20C82399D08	var: 3-10; 200 v; NP0
C202	21D82877B06	30 ±10%; 75 v N150
C203	21D82877B34	150; ±10%; 50 v; NP0
C204	21C82213E03	.0055 uf +100-0%; 75 v
C205	21D82877B33	90 ±10%; 50 v; NP0
		COIL, RF; choke; (sleeved);
L201	24C82000E21	1.2 uh
		TRANSISTOR; SEE NOTE
Q201	48R869088	P-N-P; type M9088
		RESISTOR, fixed: ±10%; 1/8 w
R201	6S185B91	10K
R202	6S185B96	27K
R203	6S185B84	2.7K

NLD6230A Crystal Kit EPD-12389-O

Y101, 201	NLD6230A	CRYSTAL UNIT, quartz: (SEE NOTE) transmitter control; sealed unit; incl compensation components (field replacement of these components not recommended)

NOTE:

Crystals are part of the complete radio set model (not part of the transmitter). When ordering crystal units, specify carrier frequency, crystal part (type) number.

REVISIONS

DIAG. ISSUE	CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION	REFER TO CIRCUIT BOARD
A	NRD1131BF-5 NRD1132BF-4	R37	WAS 6K127806, 1/4 W	PARTS LIST	NONE
B	NRD1131BF-5 NRD1132BF-4		GRAY WIRE WAS ORG	F INPUT FROM "PRI-VATE-LINE" SQUELCH DECK	EPD-11723-A

PARTS LIST for Schematic Diagram 63E81032A34-B

LEGEND
L = 132-150.8 MC
H = 150.8-174 MC

NRD6111BF Receiver Circuit Board (136-150.8 MC)
NRD6112BF Receiver Circuit Board (150.8-174 MC)

EPD-10775-C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uuf; ±10%; 75 v:
C1L	21K861462	15; N150
C1H, 4L, 19L, 9L	21K861431	12; N150
C2L	21K861434	40; N150
C2H, 5L	21D82877B06	30; N150
C3, 29	21C82450B22	0.75; 500 v
C4H, 9H, 19H	21K867807	8 ±5%; N080
C5H, 16	21D82877B01	24; N150
C6, 12, 18, 83	21K861437	100; N2200
C7, 8	21C82450B26	0.3; 500 v
C10L, 11L	21K861430	10; N150
C10H, 11H	21D82877B13	7 ±5%; N150
C14, 36, 38, 75	21K861442	.002 uf +100-20%
C15L, C25	21D82877B17	5 ±5%; N150
C17L, 88H	21K861603	3.3; NP0
C17H	21D82450B28	1
C20L, 40	21K865197	25; NP0
C20H	21K861432	20; N150
C21	21K864522	90; N080
C22, 39, 59	21D82877B02	150; N1400
C23, 24	81C831126	.002 uf GMV; 300 v
C26, 34, 89	21K864521	30; N750
C27	21K861436	100; N750
C28, 37, 42, 44, 45, 46, 48, 49, 51, 56, 61, 86	21K861443	.01 uf +100-20%
C30	21C82450B24	0.47; 500 v
C31	21D82450B24	0.47; 500 v
C32, 33	21K864067	80; N150
C35, 50	21K861444	.02 uf +100-20%
C41	21K861429	8; N150
C43, 47, 54	21K847065	500 GMV; 250 v
C52	21D82239E02	800 ±5%; 200 v
C53	23C82397D06	0.22 uf +40-20%; 35 v
C55, 70	23C82397D16	22 uf ±20%; 15 v
C57	21K864457	.002 uf +100-20%
C58, 62	8C82317B03	.03 uf; 50 v
C60	21K859943	250 ±5%; 500 v
C63, 79	23D82397D19	2 uf +40-20%; 8 v
C64	23C82397D05	4.7 uf +40-20%; 3 v
C65	23D82397D32	2 uf +40-20%; 8 v
C66, 67, 71	23C82397D17	15 uf ±20%; 20 v
C68	21C82187B16	3000; 100 v
C69	23C82397D07	1 uf +40-20%; 15 v
C72	23C82397D31	10 uf ±20%; 20 v
C73	23C82397D15	10 uf ±20%; 20 v
C74	23C82397D08	0.15 uf +40-20%; 35 v
C76	8C82317B06	.0082 uf ±10%; 100 v
C82	21K868829	220
C88L	21D82877B07	2.2; N150
		SEMICONDUCTOR DEVICE, diode: NOTE I
CR1	48C82363E03	silicon
CR2	48C859464	germanium
CR3	48C82363E01	silicon
CR4, 6, 7	48C82178A01	germanium
CR8, 9, 10, 12	48C82392B03	silicon
		COIL ASSEMBLY, RF:
L1L	24V80903A02	incl C1L, C3 and 24C82710H01 COIL, RF: VIO-BRN; does not incl 76B82451B04 CORE, tuning
L1H	24V80903A01	incl C1H, C3 and 24C82710H01 COIL, RF: VIO-BRN; does not incl 76B82451B04 CORE, tuning
L3L	24V80903A04	incl C7, C9L and 24C82711H09 COIL, RF: ORG-ORG; does not incl 76B82451B04 CORE, tuning
L3H	24V80903A03	incl C7, C9H and 24C82711H01 COIL, RF: VIO-RED; does not incl 76B82451B04 CORE, tuning
L5L	24V80903A06	incl C8, C11L, CR2 and 24C82711H03 COIL, RF: VIO-ORG; does not incl 76B82451B04 CORE, tuning
L5H	24V80903A05	incl C8, C11H, CR2 and 24C82711H03 COIL, RF: VIO-ORG; does not incl 76B82451B04 CORE, tuning
L14L	24V80903A08	incl C17L, C83L, CR3 and 24C82710H02 COIL, RF: VIO-GRN; does not incl 76B82451B04 CORE, tuning
L14H	24V80903A07	incl C17H, C83H, CR3 and 24C82710H02 COIL, RF: VIO-GRN; does not incl 76B82451B04 CORE, tuning
L15L	24V80903A10	incl C19L and 24C82710H02 COIL, RF: VIO-GRN; does not incl 76B82451B04 CORE, tuning
L15H	24V80903A09	incls C19H and 24C82710H02 COIL, RF: VIO-GRN; does not incl 76B82451B04 CORE, tuning
		COIL, RF: adjustable
L2, 4	24C82710H01	VIO-BRN; does not incl 76B82451B04 CORE, tuning
L6	24C82711H02	VIO-BLU; does not incl 76K847160 CORE, tuning, nor 76A82686D01 SLEEVE, iron (long)
L7, 8	24C82710H03	VIO-GRAY; does not incl 76K847160 CORE, tuning, nor 76A82686D01 SLEEVE, iron (long)
L9	24C82695D01	pri: 1, 2 w/center tap (5) sec: 3, 4 (tuning core incl)
L10	24C82696D01	bifilar winding (incl tuning core)
L13L	24C82711H05	VIO-BLK; does not incl 76B82451B02 CORE, tuning, nor 76A82686D01 SLEEVE, iron (long)
L13H	24C82711H04	VIO-YEL; does not incl 76B82451B02 CORE, tuning, nor 76A82686D01 SLEEVE, iron (long)
		REACTOR:
L12	25B82751D01	AF choke: 1.5 h
		TRANSISTOR: NOTE I
Q1	48R869223	P-N-P; type M9223
Q2, 5	48R869168	P-N-P; type M9168
Q3	48R869238	P-N-P; type M9238
Q4	48R869062	N-P-N; type M9062
Q6, 7, 8, 9, 10, 11	48R869057	P-N-P; type M9057
Q12, 13	48R869148	P-N-P; type M9148
Q14	48R869022	N-P-N; type M9022
Q15	48R869028	P-N-P; type M9028
Q16	48R869027	N-P-N; type M9027
		RESISTOR, fixed: ±10%; 1/4 w; unl stated
R1, 43	6K128904	18K
R2, 22, 24, 26 28, 30, 45, 47	6K127804	4.7K
R3, 4	6K129432	820
R5, 21, 23, 25, 27, 29	6K127807	33K
R6, 16	6K128687	6.8K
R7	6K128599	680
R8, 34, 69	6K127802	1K
R9	6S129230	12K
R10	6K129863	390
R11, 38, 54, 55	6K127806	27K
R12	6K129433	5.6K
R13	6K129818	820 ±5%
R14, 52, 57	6K127801	470
R15	6K128902	47K
R18, 59	6K129775	330
R19	6K129225	10K
R20, 32, 39, 44	6K128688	2.7K
R31	6K128685	22K
R33, 50	6K128689	2.2K
R37	6S185B96	27K; 1/8 w
R46	6K129144	68K
R49	6K127803	1.5K
R51	6K129233	47
R53	6K127804	4.7K
R58	6K129862	150
R60	6K128686	8.2K
R62	6K129269	1.8K
		TRANSFORMER, RF:
T1	24C82712H02	VIO-WHT; does not incl 76K861425 CORE, tuning nor 76A82686D01 SLEEVE, iron (long)
T2	24C82712H01	VIO-VIO; does not incl 76K847160 CORE, tuning, nor 76A82686D01 SLEEVE, iron (long)
T3	25B82699D01	TRANSFORMER, AF: audio input; c/o pri: imped. 10K ohms, res 1.34K ohms sec: imped. 1K ohms; res 348 ohms, coded BLU
		CRYSTAL UNIT, quartz: NOTE II
Y1	YMW-35	receiver control
Y2	YNW	11.245 mc
		NON-REFERENCED ITEMS
	1V80725A08	PRINTED CIRCUIT BD. ASSY. (2-Freq. Osc.)
	26B82671D01	SHIELD, coil: 14 req'd

NLD6221A 2nd Freq. Oscillator (132-150.8 mc)
NLD6222A 2nd Freq. Oscillator (150.8-174 mc)

EPD-12143-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: 75 v
C301L	21D82877B17	5 uuf ±5%; N150
C301H	21K861427	4 uuf ±10%; N150
C302	21D82877B01	24 uuf ±10%; N150
C303	21K861442	.002 uf +100-20%
		SEMICONDUCTOR DEVICE, diode: NOTE 1
CR301	48C82363E01	silicon
		COIL, RF:
L301L	24C82766D08	VIO-BLK; does not incl 76B82451B02 CORE, tuning
L301H	24C82766D05	VIO-YEL; does not incl 76B82451B02 CORE, tuning
		TRANSISTOR: NOTE 1
Q301	48R869168	P-N-P; type M9168
		RESISTOR, fixed: ±10%; 1/4 w
R301	6K127802	1K
R302	6K128599	680
		CRYSTAL UNIT, quartz: NOTE II
Y301	YMW-35	receiver control

NOTES:

I Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

II Crystals are part of the complete radio set model (not part of the receiver model). When ordering crystal units, specify carrier frequency, crystal frequency and crystal part (type) number.

REVISIONS

DIAG. ISSUE	CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION	REFER TO CIRCUIT BOARD
A	NTD6151AA NTD6152AA-1	C168	WAS 21C82213E02, .02 uf	Q112 BASE	EPD-11718-A
		Q112	WAS 48R869291, M9291	FINAL AMPL.	
		R135	WERE 6S185B89, 6.8K	Q111 BASE	
		R136		Q112 BASE CKT.	
		R137	WAS 6S185B90, 8.2K	Q112 BASE	
		R139	ADDED 8.2K	Q111 COLLECTOR	
		CR104	WAS 48C852462	PARTS LIST	
		CR105	ADDED 48C82178A10	Q112 BASE	
		C169	ADDED 100 uuf	Q107 COLLECTOR CIRCUIT	
		L122, 123	ADDED 0.41 uh		
		R104	REMOVED 6S185B84, 2.7K	Q102 BASE	
		L121	ADDED 1.2 uh		
		L110	WAS 24D82723H01, 1.2 uh		
		C170	ADDED 100 uuf	Q106 EMITTER CIRCUIT	
B	NTD6151AA-1	C140	REMOVED 21C82213E03, .0055 uf (132-150.8 MC ONLY)	Q107 EMITTER	EPD-11718-B
B1	NTD6151AA-1 NTD6152AA-1	L118	WAS 24B83728B01, 75 uh	Q107 COLLECTOR CKT.	NONE
		L119	WAS 24B83728B02, 75 uh		
		C159L	WAS 21D82877B06, 30 uuf		
		C160L	WAS 21K861462, 15 uuf		
		R130	WAS 6S185B98, 39K	UPPER LEFT OF Q110	EPD-11718-C
		R131	WAS 6S185B95, 22K	LOWER LEFT OF Q110	
		C130	WAS 21K864013, 50 uuf	Q106 BASE CKT.	
		C136	WAS 21K861431, 12 uuf	Q106 COLLECTOR	
		C123L	WAS 21D82877B06, 30 uuf	PARTS LIST	
		C127L, C138L	WERE 21K861430, 10 uuf		
		L107	WAS 24V80904A72, 4 TURNS	Q107 BASE	
		C128	WAS 21D82450B30, 1.8 uuf	Q105 COLLECTOR	
C	NTD6151AA-2 NTD6152AA-2	R133	WAS 6S129753, 100, 1/4 W	Q108 BASE	EPD-11718-D
D	NTD6151AA-2 NTD6152AA-2	L121, 110	WERE TRANSPOSED	Q102 BASE	EPD-11718-E

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

PARTS LIST for diagram 63E81032A32-D

LEGEND
L = 132-150.8 MC
H = 150.8-174 MC

NTD6151AA Transmitter (132-150.8 MC)
NTD6152AA Transmitter (150.8-174 MC) EPD-12373-C

		CAPCITOR, fixed: uuf; ±10%; 75 v; unl stated
C101	20C82399D08	var: 3-10; 200 v; NP0 (GRY)
C102	21D82877B06	30; N150
C103	21D82877B34	150; 50 v; NP0
C104, 106	21D82877B33	90; 50 v; NP0
C105, 110, 113, 156	21C82213E03	.0055 uf +100-0%
C107	21D82877B31	50; 50 v; NP0
C108, 147	21K847065	500 +100-0%; 25 v
C109, 118L, 119L, 130L	21K861435	70; N150
C111	23C82397D09	6.8 uf +40-20%; 10 v
C112,126,132, 133,153, 158, 161,163,168,169	21K861436	100; N750
C114, 121H, 123L	21K861433	36; N150
C115, 127H	21D82877B13	7 ±5%; N150
C116, 124, 150	21K851299	600; 600 v
C117, 128L	21K861426	2.2; N150
C118H, 119H	21K864012	60; N150
C120	21D82877B05	150; N750
C121L, 130H	21K864013	50; N150
C122	21K861603	3.3 ±0.25 uuf; NP0
C123L	21K861434	40; N150
C123H	21K865197	25; N150
C125	21K861438	220; N1400
C127L, 138H	21K861429	8; N150
C128H	21D82450B30	1.8 ±5%; 500 v
C129L,136,138L	21K861462	15; N150
C129H, 160L	21K861431	12; N150
C134, 141, 148, 162, 164, 170	21K861437	100; N2200
C135	20C82399D07	var: 15-60; 200 v; N1500
C137	21C82880E22	500; 350 v
C139	20C82399D05	var: 9-35; 200 v; N650
C140	21C82213E03	.0055 uf +100-0% (150.8-174 MC only)
C142	21D82877B46	18; N150
C149	23C82397D03	10 uf ±20%; 6 v
C152	8C82548E03	.005 uf; 100 v
C154	8C82548E04	.022 uf; 100 v
C155	23C82397D17	15 uf ±20%; 20 v
C157	23D82397D15	10 uf ±20%; 20 v
C159L	21D82877B01	24; N150
C159H	21K861432	20; N150
C160H	21K861430	10; N150
C165	23C82397D05	4.7 uf +40-20%; 3 v
C166	23C82397D07	1 uf +40-20%; 15 v
C167	23D82397D28	3.3 uf ±20%; 20 v
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR101	48C82392B03	silicon
CR102	48C82178A01	germanium
CR103	48D82256C08	silicon; zener; 8.2 v ±5%
CR104,105	48C82178A10	germanium
		COIL, RF:
L101	24V80904A41	BLK, YEL; incl 76B82451B02 CORE, tuning
L102	24V80904A37	11 turns; BLK, BLK; incl 76K861425 CORE, tuning
L103, 104, 107L	24V80904A39	5 turns; BLK, RED; incl 76K861425 CORE, tuning
L105, 106, 107H	24V80904A72	4 turns; BLK, YEL; incl 76K861425 CORE, tuning
L108	24V80904A73	6 turns; BLK, GRN; incl 76B82451B04
L109,121	24D82723H01	choke; 1.2 uh
L110	24D82549D03	choke; 1 mh
L111	1V80754A98	assy. 1.2 uh; incl. ref. C132
L112, 122	24C82000E22	choke; (sleeved); 0.41 uh
L114	24D82723H11	choke; 0.2 uh; BRN, BRN
L117	24C82000E21	choke (sleeved); 1.2 uh
L118L	24D82723H13	choke; 85 uh
L118H	24D82723H15	choke; 75 uh
L119L	24D82723H12	choke; 85 uh
L119H	24D82723H14	choke; 75 uh
L120	24C83961B01	choke; BRN
L123	1V80754A99	assy.; 0.41 uh

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		REACTOR:
L116	25B82872B01	a-f choke; 0.8 h; res 200 ohms max.
		TRANSISTOR: SEE NOTE
Q101	48R869088	P-N-P; M9088
Q102	48R869058	P-N-P; M9058
Q103	48R869009	P-N-P; M9009
Q104	48R869008	P-N-P; M9008
Q105	48R869218	N-P-N; M9218
Q106	48R869217	N-P-N; M9217
Q107	48R869213	N-P-N; M9213
Q108, 109, 110	48R869148	P-N-P; M9148
Q111	48R869277	N-P-N; M9277
Q112	48R869119	N-P-N; M9119
		RESISTOR, fixed: ±10%; 1/4 w; unl stated
R101	6S185B91	10K; 1/8 w
R102	6S185B96	27K; 1/8 w
R103	6S185B84	2.7K; 1/8 w
R105	6S129269	1.8K
R106	6S129230	12K
R107	6S128599	680
R108	6S185B81	1.5K; 1/8 w
R109	6S128685	22K
R110	6S185B87	4.7K; 1/8 w
R111	6S129620	560
R112, 129	6S129775	330
R113	6S185B74	390; 1/8 w
R114	6S129617	120
R115	6S185B64	56; 1/8 w
R116	6S127800	220
R117	6S131650	18
R122	6S185A75	12K ±5%; 1/8 w
R123	6S185A73	10K ±5%; 1/8 w
R124	6S185A57	2.2K ±5%; 1/8 w
R125	6S124A60	3K ±5%
R126	6S185B66	82; 1/8 w
R127	6S127806	27K
R128	18C82876B04	var: 2K ±15%; 1/20 w
R130	6S185A77	15K ±5%; 1/8 w
R131	6S185A69	6.8K ±5%; 1/8 w
R132	6S185B85	3.3K; 1/8 w
R133	6S185B67	100; 1/8 w
R134	6S128689	2.2K
R135	6S185A67	5.6K ±5%; 1/8 w
R136	6S185A87	39K ±5%; 1/8 w
R137	6S185A81	22K ±5%; 1/8 w
R138	17C82069G03	0.75 ±3%; 1 w
R139	6S185A71	8.2K ±5%; 1/8 w
		THERMISTOR:
RT101	6B82696B01	10K ±10%; @ 25°C
		TRANSFORMER, RF:
T101	24V80904A42	BLK; does not incl 76K861425 CORE, tuning
		FILTER, low pass: (harmonic filter)
Z101L	1V80752A91	incl. C159L, C160L, L118, L119
Z101H	1V80752A87	incl. C159H, C160H, L118, L119
	NON-REFERENCED ITEMS	
	1V80754A32	AUTOMATIC DRIVE LIMITER
	26B82671D07	SHIELD, coil: 9 req'd.
	2A83325B01	NUT, machine: (for mtg. Q107)
	76A82686D02	SLEEVE, powdered iron: (used L102, T1)

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

NLN6415A XMTR. Osc. (F2) EPD-12134-A

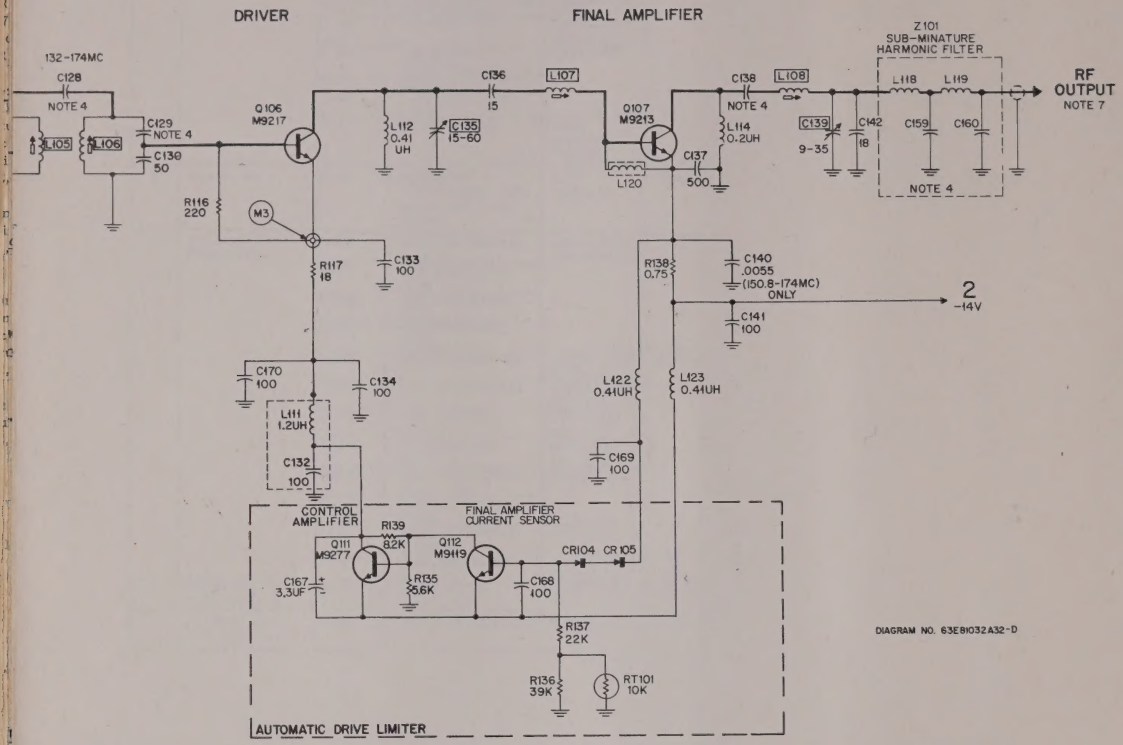
		CAPACITOR, fixed: uuf
C201	20C82399D08	var: 3-10; 200 v; NP0
C202	21D82877B06	30 ±10%; 75 v N150
C203	21D82877B34	150; ±10%; 50 v; NP0
C204	21C82213E03	.0055 uf +100-0%; 75 v
C205	21D82877B33	90 ±10%; 50 v; NP0
		COIL, RF; choke; (sleeved);
L201	24C82000E21	1.2 uh
		TRANSISTOR; SEE NOTE
Q201	48R869088	P-N-P; type M9088
		RESISTOR, fixed: ±10%; 1/8 w
R201	6S185B91	10K
R202	6S185B96	27K
R203	6S185B84	2.7K

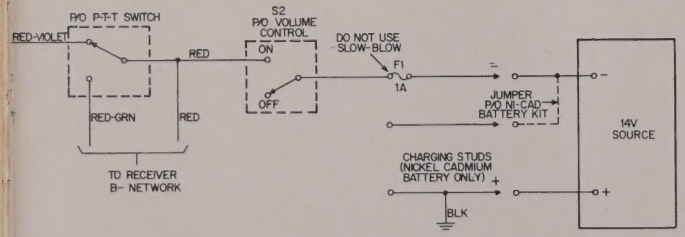
NLD6230A Crystal Kit EPD-12389-O

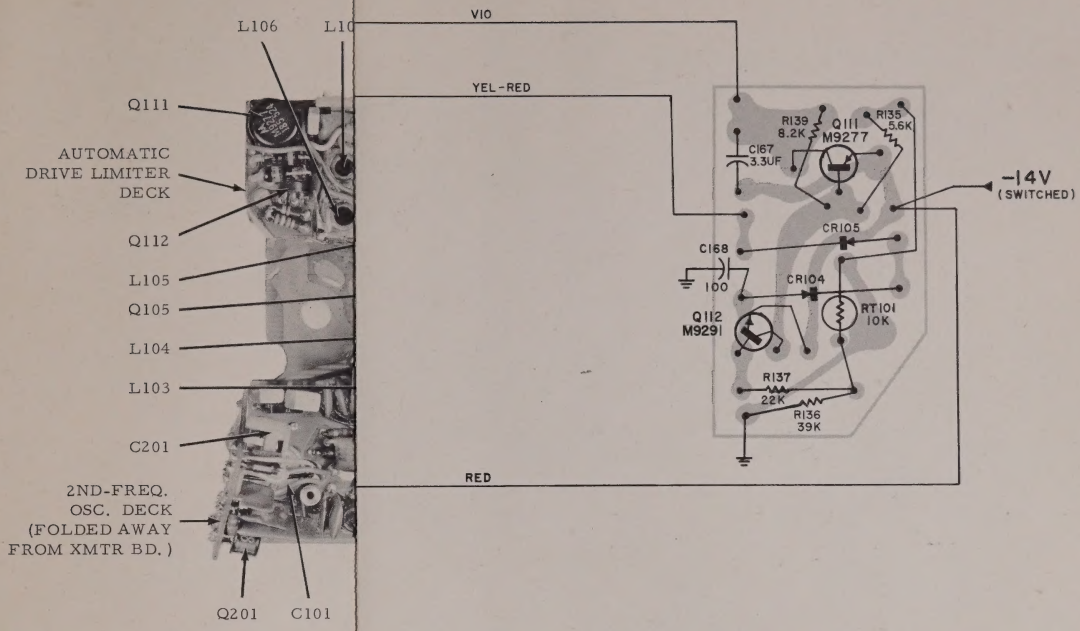
Y101, 201	NLD6230A	CRYSTAL UNIT, quartz: (SEE NOTE) transmitter control; sealed unit; incl compensation components (field replacement of these components not recommended)

NOTE:

Crystals are part of the complete radio set model (not part of the transmitter). When ordering crystal units, specify carrier frequency, crystal part (type) number.

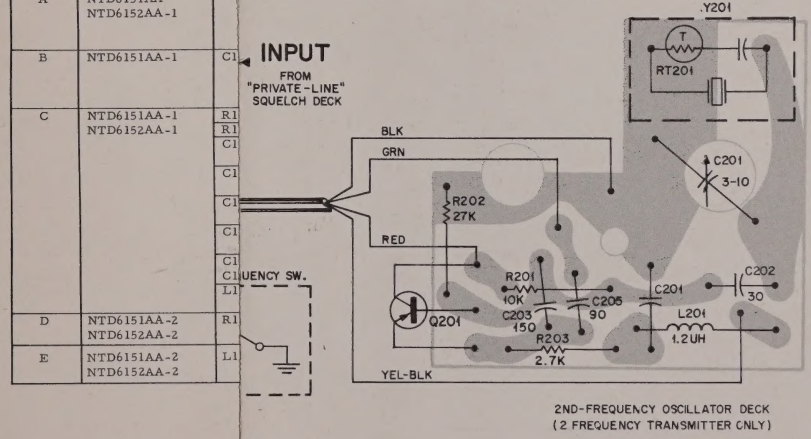

DRIVER
FINAL AMPLIFIER
132-174MC
C128
NOTE 4
L105
L106
C129
NOTE 4
C130
50
Q106
M9217
R116
220
M3
R117
18
C133
100
L112
0.41
UH
C135
15-60
C136
15
L107
Q107
M9213
L120
C137
500
C138
NOTE 4
L108
L114
0.2UH
C139
9-35
C142
18
Z101
SUB-MINATURE
HARMONIC FILTER
L118
L119
C159
C160
NOTE 4
RF
OUTPUT
NOTE 7
R138
0.75
C140
.0055
(150.8-174MC)
ONLY
C141
100
2
-14V
C170
100
C134
100
L111
1.2UH
C132
100
L122
0.41UH
L123
0.41UH
C169
100
CONTROL
AMPLIFIER
FINAL AMPLIFIER
CURRENT SENSOR
R139
8.2K
Q111
M9277
Q112
M9119
CR104
CR105
C167
3.3UF
R135
5.6K
C168
100
R137
22K
R136
39K
RT101
10K
AUTOMATIC DRIVE LIMITER
DIAGRAM NO. 63E81032A32-D


P/O P-T-T SWITCH
RED-VIOLET
RED
RED-GRN
RED
TO RECEIVER
B- NETWORK
S2
P/O VOLUME
CONTROL
ON
OFF
DO NOT USE
SLOW-BLOW
F1
1A
JUMPER
P/O NI-CAD
BATTERY KIT
14V
SOURCE
CHARGING STUDS
(NICKEL CADMIUM
BATTERY ONLY)
+
BLK
-
+



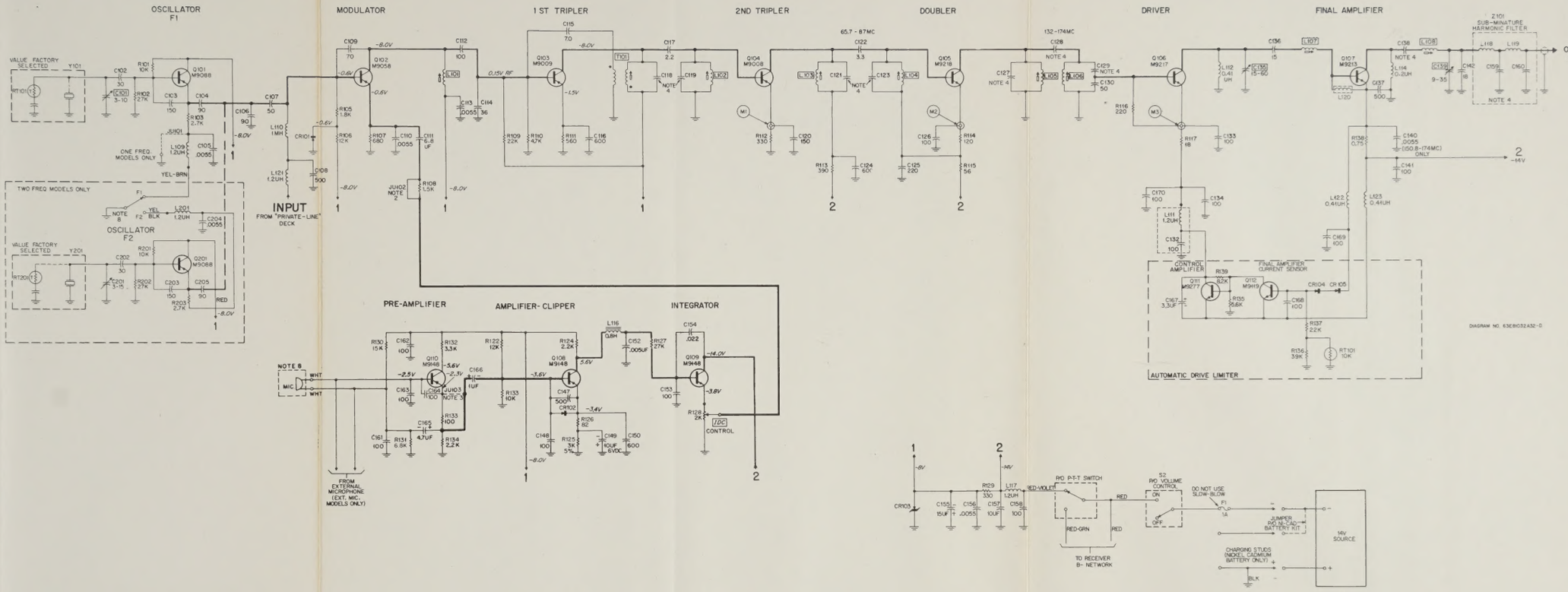
DEPD-11891-D

DIAG. ISSUE	BOARD AND SUFFIX NO.	F SY
A	NTD6151AA NTD6152AA-1	
B	NTD6151AA-1	C1
C	NTD6151AA-1 NTD6152AA-1	R1 R1 C1 C1 C1 C1 C1 C1 L1
D	NTD6151AA-2 NTD6152AA-2	R1
E	NTD6151AA-2 NTD6152AA-2	L1



2ND-FREQUENCY OSCILLATOR DECK
(2 FREQUENCY TRANSMITTER ONLY)

132-174 MC "Handie-Talkie"
FM Two-Way Radio Sets
Transmitter Printed Circuit Board
And Wiring Diagram
Motorola No. EPD-11718-E



NOTES:

1. UNLESS OTHERWISE NOTED:
   RESISTOR VALUES ARE IN OHMS, K=1000
   CAPACITOR VALUES ARE IN MICROMICROFARADS
2. JUMPER JU102 REMOVED IN "PRIVATE-LINE" TONE-CODED SQUELCH MODELS.
3. JUMPER JU103 MAY BE REMOVED FOR OPERATION IN AREAS OF HIGH BACKGROUND NOISE.
4. REFER TO PARTS LIST FOR VALUE.
5. FREQUENCY CALCULATION:

$$f_o = \frac{f}{18}$$

6. ALL DC VOLTAGE READINGS TAKEN WITH A MOTOROLA DC MULTIMETER.
7. REFER TO INTERCABLING DIAGRAMS.
8. PART OF HOUSING KIT ON 2-FREQUENCY MODELS ONLY.

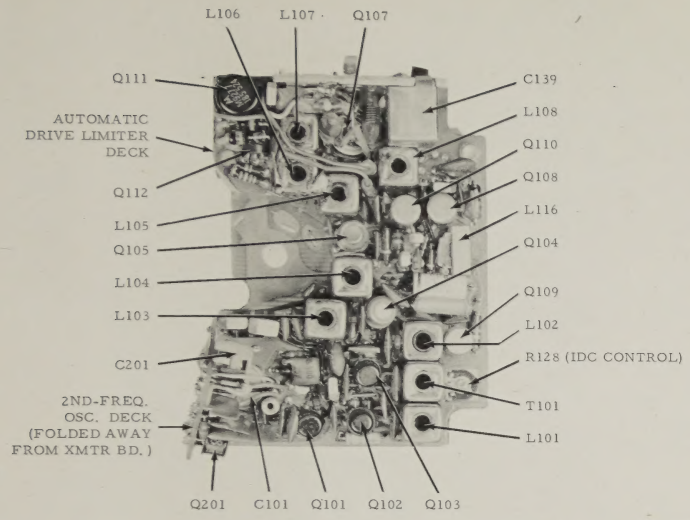
MODEL TABLE

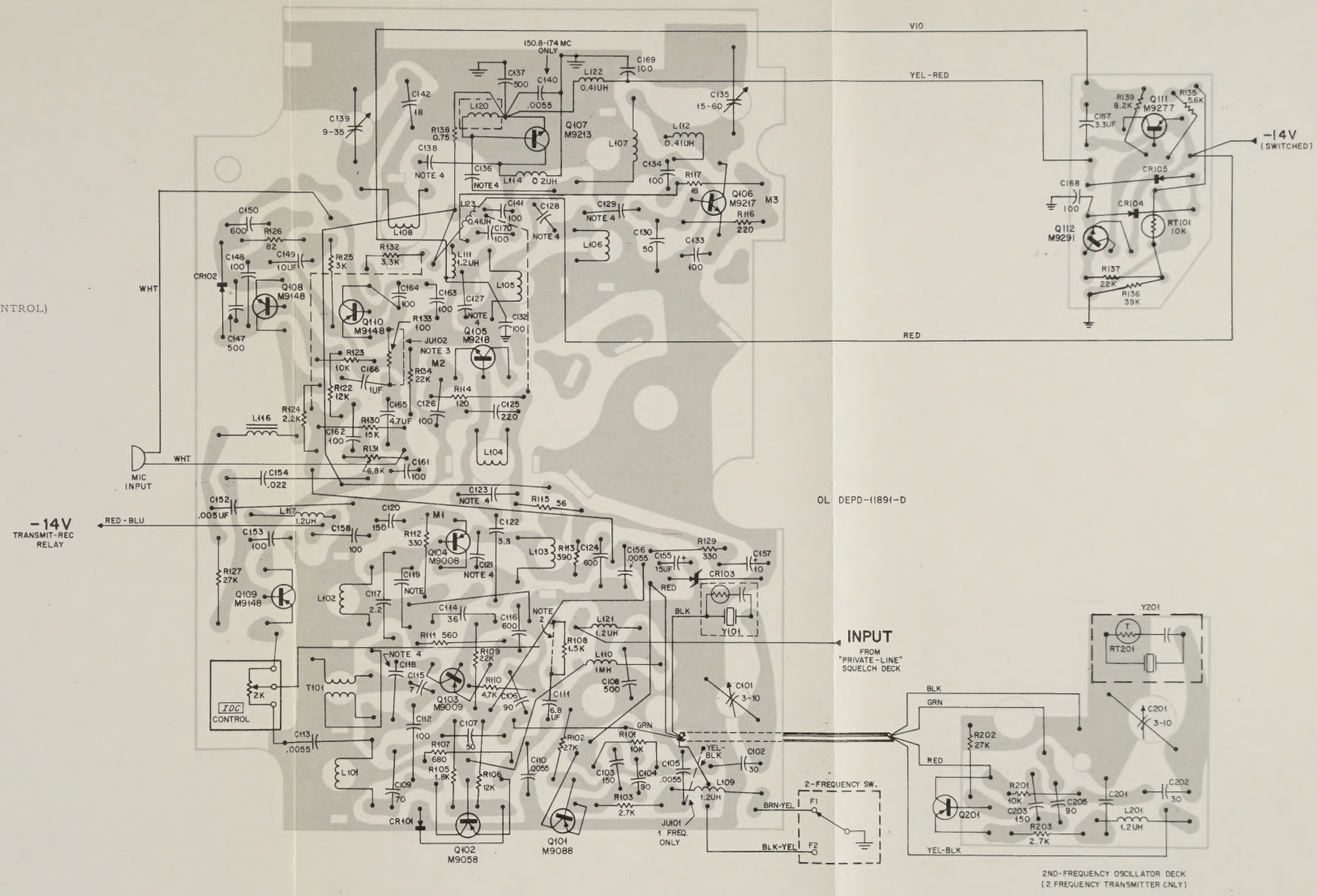
MODEL		CHASSIS SUFFIX	FREQ. RANGE
TRANSMITTER	NTD6151AA	2	132-150.8 MC
	NTD6152AA	2	150.8-174 MC
TRANSMITTER 2ND OSC. DECK	NLN6415A		

EPD-12029-C

PREVIOUS REVISIONS LISTED ON BACK OF THIS DIAGRAM

132-174 MC "Handie-Talkie"
FM Two-Way Radio Sets
Transmitter Schematic Diagram
Motorola No. 63E81032A32-D





REVISIONS

DIAG. ISSUE	BOARD AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
A	NTD6151AA NTD6152AA-1		EXTENSIVE PRINTED CIRCUIT BOARD AND COMPONENT CHANGES	
B	NTD6151AA-1	C140	REMOVED 21C82213E03, .0055 uf (132-150.8 MC ONLY)	Q107 EMITTER
C	NTD6151AA-1 NTD6152AA-1	R130	WAS 6S185B98, 39K	BELOW Q110
		R131	WAS 6S185B95, 22K	
		C128	WAS 21D82450B30, 1.8 uuf	BELOW Q107
		C130	WAS 21K864013, 50 uuf	Q106 BASE
		C136	WAS 21K861431 12 uuf	PARTS LIST
		C123L	WAS 21D82877B06, 30 uuf	
		C127L, C136L	WERE 21K861430, 10 uuf	
		L107	WAS 24V80904A72, 4 TURNS	
D	NTD6151AA-2 NTD6152AA-2	R133	WAS 6S129753, 100, 1/4 W	Q110 EMITTER
E	NTD6151AA-2 NTD6152AA-2	L121, 110	WERE TRANSPOSED	Q102 BASE

132-174 MC "Handie-Talkie"
FM Two-Way Radio Sets
Transmitter Printed Circuit Board
And Wiring Diagram
Motorola No. EPD-11718-E

MOTOROLA

INSTRUCTION MANUAL REVISION MR-1847

GENERAL

This revision outlines changes that have occurred since the printing of your instruction manual. Use this information to correct your manual.

INSTRUCTION MANUAL(S) AFFECTED:

132-174 MC "Handie-Talkie" PT and HT Series Radio Sets
132-174 MC Lookout and Repeater Radio Sets

REVISION DETAILS

With this change the following becomes effective:

Instruction Manual No.	Schem. Diag. & New Issue	Xmtr. Chassis	New Suffix	Ckt. Bd. Detail	New Issue	Change Item No.
68P81032A35-O	63E81032A29-C	NTD6151AA	3	EPD-12689	D	4
68P81032A30-B	63E81032A32-E	NTD6152AA	3	EPD-11718	F	4
		Xmtr. Osc. Bd.				
68P81032A40-B	63E81032A43-F	NLN6415A	1	EPD-11724	G	1,2,3
68P81032A35-O	63E81032A29-C			EPD-12689	D	1,2,3
68P81032A30-B	63E81032A30-B			EPD-11718	F	1,2,3
68P81036A20-O	63E81036A21-D			EPD-12537	D	1,2,3

*NOTE

When the letter "A" follows the suffix number stamped on your unit, it indicates some of the previous changes are not included.

Change Item No.	Ref. Sym.	Action	Part Number	Description
1	R203	Changed to	6S185B83	RESISTOR, fixed; 2.2K ±10%; 1/8 w
2	R204	Added	18C82876B04	RESISTOR, var. 2K ±15%; 1/20 w SEE FIGURE 1
3	R205	Added	6S185B87	RESISTOR, fixed: 4.7K ±10%; 1/8 w SEE FIGURE 1
4	R127	Changed to	6S127806	RESISTOR, fixed: 27K ±10%; 1/4 w

SUPPLEMENTARY REMARKS:

In the IDC Adjustment Procedure for Instruction Manuals 68P81032A40-B, 68P81032A35-O, 68P81032A30-B, and 68P81036A20-O, make the following additions:

1. After paragraphs 4.a. and 4.b., add the following:

   Two-Frequency Models:

   (a) Adjust deviation of the F1 channel as indicated in the preceding steps.

   (b) Check the deviation of the F2 channel. If the deviation is not correct, adjust R204 for proper level.

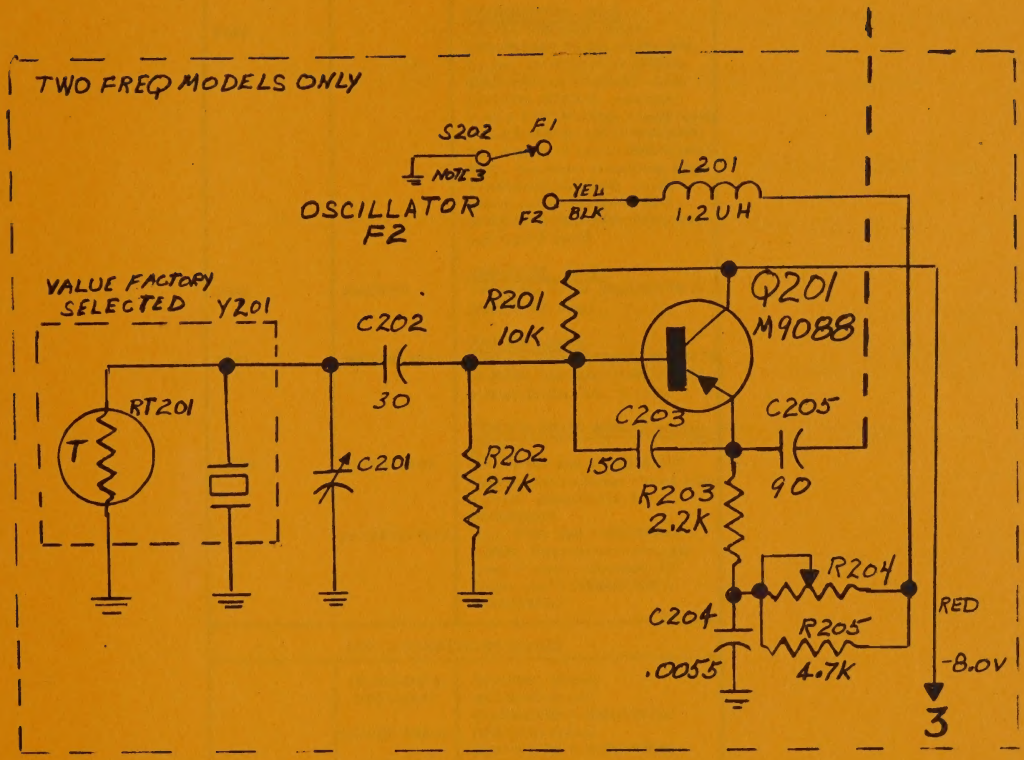
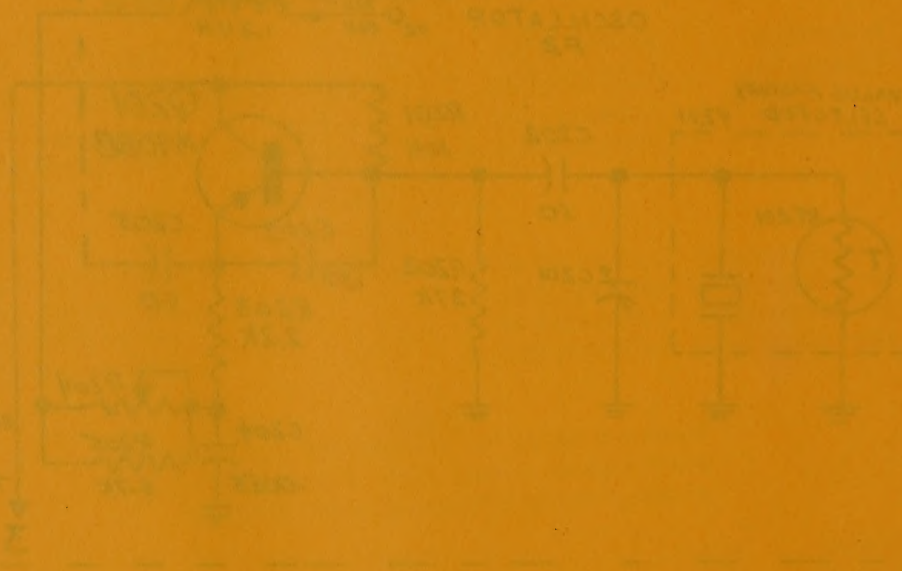

TWO FREQ MODELS ONLY
S202
F1
NOTE 3
OSCILLATOR
F2
F2
YEL
BLK
L201
1.2 UH
VALUE FACTORY
SELECTED
Y201
C202
30
R201
10K
Q201
M9088
RT201
T
C201
R202
27K
C203
150
C205
90
R203
2.2K
R204
C204
.0055
R205
4.7K
RED
-8.0V
3

FIGURE 1



"Plug-In" Microphones

Conventional Type
NMN6023B (coiled cord)
NMN6024B (straight cord)

Noise-Cancelling Type
NMN6027B (straight cord)
NMN6028B (coiled cord)

EPD-13444-O

C501	8C82396B07	CAPACITOR, fixed: .05 uf ±20%; 50 v (NMN6027B & NMN6028B only)
DP501	59C82960G01	CARTRIDGE: microphone: reluctance type (NMN6023B & NMN6024B)
	or59C83361B01	reluctance type (NMN6027B & NMN6028B)
P501		CONNECTOR, plug: c/o the following items: 1V80755A89 PLUG ASSY: fem. 7 cont. 15C83261C01 SHELL 42B83262C01 CLAMP, cable 3S122924 SCREW, machine: 4-40 x 1/4" Phillips round head; 2 req'd 4S9743 LOCKWASHER: No. 4 split; 2 req'd 2B82681H03 NUT, machine: (retaining ring) 37A868208 SLEEVE, cord, strain relief 3S120421 SET-SCREW: 4-40 x 1/8" Allen hd; cup type 2 req'd
R501	6S129753	RESISTOR, fixed: 100 ±10%; 1/4 w (NMN6027B & NMN6028B only)
S501	40C82863E01	SWITCH, push: spst no; does not incl. 3S129172 SCREW, machine: 3-48 x 3/8" slotted binder hd; 2 req'd
W501	1V80757A98	CORD & PLUG ASSY., micro-phone: incl. P501 and 30D82565B21 CORD, microphone: coiled type; 4 cond. (NMN6023B & NMN6028B)
	or 1V80755A92	incl. P501 and 30B82285H01 CORD, microphone: straight type; 5 cond.; shielded; 28" length req'd (NMN6024B & NMN6027B)

NON-REFERENCED ITEMS

	15C82828E01	HOUSING (front)
	1V80748A50	HOUSING (rear) (NMN6023B & NMN6024B)
	or 1V80750A12	HOUSING (rear) (NMN6027B & NMN6028B)
	41B82856E01	SPRING, backup
	38B82833E01	PUSHBUTTON
	35A82853E01	DIAPHRAGM, microphone protector (2 req'd for NMN6027B & NMN6028B)
	4C82418B22	WASHER, insulating
	75A82852E01	PAD, rubber, 1.24" dia.
	75A82192A02	PAD, rubber, 0.562" dia.
	64A82826E01	PLATE, tapped
	7B82801E01	BRACKET, hold-down (NMN6023B & NMN6024B)
	or 7B82801E03	BRACKET, hold-down (NMN6027B & NMN6028B)
	32A82661C02	GASKET (NMN6023B & NMN6024B)
	or32A82661C03	GASKET (NMN6027B & NMN6028B)
	42B82831E01	CLAMP, cable
	1V80727A18	SPRING & BUSHING ASSY.
	1V80727A20	BOARD (eyeleted)

INSTRUCTION MANUAL REVISION T-2026

GENERAL

This revision outlines changes that have occurred since the printing of your instruction manual. Use this information to correct your manual.

INSTRUCTION MANUAL AFFECTED:

Motorola HT Series "Handie-Talkie" ® FM Radio

REVISION DETAILS

With this addition the following becomes affective:

Instruction Manual No.	Schematic Diag. & New Issue
68P81032A30-B	63D81033A17-B

Add the following to the parts list: